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CONTENTS.

An Asterisk (*) denotes an illustrated article.

EDITORIALS—

Twenty-third Annual Meeting, Western Gas Association—Special Editorial Correspondence 805

The Society of Gas Lighting Adheres to Its Standard of Flanges, etc., for Gas Works Castings 806

*Inclined Retorts at the Bankside Works of the South Metropolitan Gas Company, London, England, by Mr. C. C. Carpenter 807

The Empty Coal Cellar 812

Prospecting for Petroleum in California 812

The Properties of Carbon in Electrical Work, by Mr. Elihu Thomson 813

The Protective Power of Paints 815

Electrical Conductors and Dirt 815

ITEMS OF INTEREST FROM VARIOUS LOCALITIES 816

The Bath (Me.) Company Changes Hands—Mr. Welch in Full Control at Athens, O.—The Terms of Subscription to New Haven Company's Increased Capital—Hints from Baltimore, Md.—Increased Selling Rate, Hanover, Pa.—Annual Meeting, Marshall, Mo.—Lectures on Gas Cooking, Van Wert, O.—The Keokuk (Iowa) Company Changes Hands—Mr. H. Payne Appointed Gas Inspector for Cleveland, O.—Resolutions Regarding the Retirement of Mr Robt. Allison—Annual Meeting, Wyandotte Co., Bethlehem, Pa.—Restraining a Gas Consumers Protective Association—A Hint from Johnstown, N. Y.—Death of Mr. F. Geise—Public Lighting, Stoughton, Mass.—Lectures on Cooking by Gas, Dallas, Texas—Annual Meeting, Winona, Minn.—An Important Opinion Concerning the Labor Employed by the Municipal Company, Albany, N. Y.—And Other Items.

Novel Use for a Pile Driver 817

The Market for Gas Securities 818

[Special Editorial Correspondence.]

TWENTY-THIRD ANNUAL MEETING, WESTERN GAS ASSOCIATION.

AUDITORIUM HOTEL, CHICAGO, May 16, 1900.

Dear JOURNAL: It required much faith in the eternal fitness of things to feel that those who started from New York last Monday afternoon, to take part in the 23d annual meeting of the Western Gas Association, set for Chicago on the following Wednesday, Thursday and Friday, were to enjoy life on the appointed dates. Leaving New York in the certain knowledge that all warm weather records for May 14th had been shattered, and railroading it to the Windy City under the impression that it was growing warmer all the time, one's faith in the law of averages revived when the early evening in Chicago of Tuesday found many inclined to look up wraps and light overcoats. But so it was; and likewise did the change appeal to one's comfort. Quite a delegation was on hand in the Auditorium the evening of the 15th, and this morning the numbers were impressive. In fact, no less than 150 delegates assisted in the proceedings of the first day. Many of the members are accompanied by their wives and daughters, and the Committee of Arrangements have seen to it well that their comfort and entertainment were not neglected. There was a slight hitch in the meeting room preparation. The morning session to-day was held in the banquet room, whereas in the afternoon it was necessary to assemble in one of the parlors, but for to-morrow the snarl has been untangled, so that the day's sessions will be brought off in the banquet hall. The general sentiment amongst those present regarding the state of trade and the outlook is undeniably of the sanguine sort, although one often hears a decided remark to the effect that high prices for materials of all sorts necessary in and to the development of the gas business are menacing to the desire to sell gas at lower figures. However, one may not truthfully deny that the prevalent feeling is of the sanguine order.

The meeting was called to order shortly after 10 o'clock this morning, by the President, Mr. William McDonald, of Albany, N.Y. Trim and suave he was when he announced the regular order, and Secretary Dunbar looked approvingly at his superior officer. It was a glance rather than a look; but it was enough to suggest to an observer that the Secretary's thought was, "Well, here's a veteran in the art of directing." Without ado or friction the President introduced Mr. Howard S. Taylor, Prosecuting Attorney for Chicago, who represented Mayor Harrison, in the latter's unavoidable absence. Mr. Taylor's clever speech of welcome was responded to in splendid vein by Capt. W. H. White, whose witty and concise paragraphs more than once disestablished silence and serenity. A trifle of routine business followed, and then came the President's Address, Second Vice-President T. D. Miller assuming the Chair—the First Vice President, Mr. I. C. Copley, being in Europe. The address was listened to with close attention. It was quite characteristic of its author, who, without taking unto himself all-in-one the entire knowledge of the gas business of the times, brought out in clear relief at least three points that will do to study when the message appears in print. It was a really clever paper. The address having been referred to a committee for consideration and report, the President appointed special committees on Place for Next Meeting, on Memorials and on Final Resolutions.

Then came the report of the Board of Directors, the reading of which showed how well the Association was maintaining its usefulness and growth. This brought the order to the reading of the first paper, by Mr. Howard C. Slater, of Milwaukee, Wis., whose theme was "Regenerative Benches." He treated his subject in good style, and was rewarded by a brisk discussion. The Secretary then read many letters from those unable to be present at the meeting, and the two that appealed most to the audience were those sent by George Treadway Thompson and A. W. Littleton, each of whom had labored long, faithfully and well for the Association. The roll call having shown how excellent the attendance was, the morning's session was brought to a close by a very interesting discussion on the topic of pumping gas under high pressure, the champion for the practice being Mr. F. H. Shelton, who, as our readers well know, has had something to say on this matter at other times.

The afternoon session was convened at 2:30, the opening number being the paper by Mr. W. H. Barthold, of Grand Rapids, Mich., who presented a well thought out sketch respecting "Temperatures in Condensation." The brisk discussion on it was followed by the report of Committee on President's Address, who recommended among other things that in future at least every third convention should be held in Chicago, and that President McDonald should be authorized to appoint such delegates to represent the Association at the International Congress of gas men in Paris, next September, as he should determine. Then came the paper by Mr. George McLean, of Dubuque, Iowa, whose remarks on "Public Control of Rates" brought out a rousing debate. In fact some of it was so pointed that I fear it will not all appear in

print. The next chapter in order was the paper entitled, "Monthly Technical Report of Operation in Coal Gas Works," by Mr. W. E. Steinwedell, of Belleville, Ills. He handled his subject well, and the tables in his paper, which reflect the knowledge of good and useful practice, will often be referred to. The report of the Committee on Publication of Proceedings brought out a hearty vote of thanks, and the determination to order its members to keep on with their good work. A mild surprise was here occasioned by the overturning of the report of the Committee on Next Place of Meeting. The committee recommended St. Louis, but the convention decided to go to Louisville, where all may then see a pretty good installation of inclined retorts at work. A dip into the Question Box closed the technical work of the day. The afternoon was showery and cool, which weather conditions, especially as to the coolness, were sufficient to keep the delegates in good desire for sightseeing, opportunity for which is abundant.—S.

CHICAGO, May 17, 1900.

Dear JOURNAL: The second day's sessions were called to order at 9:30 A.M. The first business in order was the election of officers, the ballot resulting as follows:

President—I. C. Copley, Aurora, Ills.
First Vice-President—Thomas D. Miller, Dallas, Texas.
Second Vice President—A. H. Barret, Louisville, Ky.
Secretary and Treasurer—James Dunbar, New Albany, Ind.
Board of Directors (to serve two years)—M. N. Diall, H. C. Slater, Donald McDonald and J. R. Lynn.
Editor Wrinkle Department—Fred. H. Shelton, Philadelphia.

The election disposed of, the Secretary read a cablegram from President-elect Copley, who wished the Association success from abroad, and Mr. J. B. Howard raised a fraternal shout by moving that Mr. Copley be notified by telegram of his election to the Presidency. It is needless to say that the motion was adopted with a vim. The Committee on Memorials here presented a beautiful word tribute to the Association's deceased during the year—Col. Jerome Croul, of Detroit, and Mr. James Gardner, Jr., of Pittsburg, Pa. Next in order was the election of new members, and that the result was surprising may not be gainsaid, for the ballot showed the adding of 42 active and 10 associate members, respectively, to the rolls, and further, the graduating of four from the associate to the active class. By-and-large, the result should be taken as proof positive that the Western Association and the gas business of the Western States as well, are in the field for the present and the future. Following the changes in the membership list came the paper by Mr. John R. Lynn, of Portsmouth, Ohio, who presented some original thoughts on "Candle Power: Its Present Relation to the Gas Industry." He did not mince matters much, and the same might be said respecting the remarks of those who shared in the snappy discussion that followed. The next number disposed of was the paper by Mr. Donald McDonald, of Louisville, Ky., whose subject was "The Systematic Location of Gas Mains as Opposed to a Conduit." Mr. McDonald's paper was followed by the one from Mr. Thos. D. Miller, of Dallas, Texas, who wrote on the "Hygienic Effect of the Use of Gas." As is usual with Mr. Miller, he wrote entertainingly, and it is to be regretted that the discussion which ensued was shortened by the appearance of the photographer, whose mission was "to take the Association by flashlight, as assembled in convention." The photographer's work, which was undertaken by him in a doubtful frame of mind as to the result, concluded the morning session.

The afternoon's proceedings were commenced at 2:30, the opening number being the paper by Mr. James Somerville, of Indianapolis, Ind., who gave an interesting experience in the matter of "Telescoping a Gasholder." The last regular paper, by Mr. J. C. Small, of Aurora, Ind., on "The Operation of a Central Station Electrical Plant with a Gas Engine," in the absence of the author, was read by Mr. Fred. H. Shelton. At this point Mr. Henry L. Doherty succeeded in carrying through a motion to have the Association appoint a committee of one to confer with other Associations respecting the advisability of forming a national bureau for advertising the advantages of gas for lighting, cooking, heating, etc. The report of the Committee on Cyanides was next received. It was accepted, and the committee was discontinued, the action being accomplished by a well merited vote of thanks. At this point Editor Shelton unfolded his collection of Wrinkles, and an interesting lot they proved to be. They also proved that the Association had done wisely and well in re-electing that clever statistician and news gatherer to another editorial term. The Wrinkles having been disposed of, the report from the Committee on Isolated Generators, read by Mr. W. E. Steinwedell, was discussed and accepted, and the committee was ordered discontinued. The discharging of the committee, however, was followed by the appointment of another charged with the task of investigating the best method of operating recuperative benches.

The contents of the Question Box now came in for sifting. The queries, though few in number, were of sufficient interest to put a good finish to the technical side of the convention, which was declared adjourned at 5:30 P.M. This fact shows how well the President kept the proceedings in hand, and further shows how sturdily the members assisted in the work of expediting the meeting. The feminine delegation was well taken care of by the Committee of Arrangements. The outing arranged for to-day included an automobile ride through the city and a trip through the public parks, with a luncheon at the hotel on their return. In the evening it is proposed to visit Power's Theater, where "The Christian" is being shown in all its glare and glory by the company headed by Miss Viola Allen. At the present time everyone is getting ready for the beefsteak dinner, that is to be served to-night in the well appointed rooms of the Chicago Athletic Club, and a rough estimate just now of the likely attendance puts the latter at not less than 200. To-morrow (Friday) the Association will inspect, by formal invitation, one or more of the plants of the Peoples Gas Light and Coke Company.—S.

CHICAGO, May 18, 1900.

Dear JOURNAL: The beefsteak dinner last night was a rousing success, and my estimate of the attendance was on the short side. Good appetites, choice food well served, a presiding genius who thoroughly knew his business, and the truest of fraternality caused the dinner to be of the sort that is thoroughly enjoyed. The weather is blustery and cool this morning, but there is evidence on every side that many will make the visit of inspection to the Peoples Company's works, for at least 20 coaches are now in waiting for the party. The meeting was excellent from anyone's point of view. The officers were alert and capable, the members were attentive and interested, the Committee of Arrangements left nothing undone that they should have done, and Chairman Williamson and his associates thoroughly deserved the hearty vote of thanks awarded them. In fact the Western can put on record the history of another meeting that goes to show how much can be accomplished for the advancement of the gas industry by persistent and harmonious working.—S.

The Society of Gas Lighting Adheres to Its Standard of Flanges, etc., for Gas Works Castings.

The following report, submitted by the Committee appointed by the Society of Gas Lighting to consider proposed alterations in its standard of flanges for gas works castings, was received and adopted, at a meeting of the Society held the 10th inst.:

To the Members of the Society of Gas Lighting: To your Committee on Special Castings was referred a communication received from the United States Cast Iron Pipe and Foundry Company, written in response to an invitation to adopt our standard of bells, flanges, etc., for gas works specials.

They in turn invited us, or the American Gas Light Association, which Association has joined us in the matter of this standard, to abandon that part of it which refers to sizes of flanges, bolts, etc., and instead of ours to follow the standard set up by several Eastern valve manufacturers, and also (but this is only by hearsay) by the National Association of Master Steam and Hot Water Fitters, the American Society of Mechanical Engineers, R. D. Wood & Company, etc.

The flanges proposed by these people differ from ours, being as a rule of a greater diameter and heavier in metal, and by being arranged for a greater number of bolts.

Now, when this Society took up the matter of standards for flange and bell work in 1891, we consulted the patterns of all the leading pipe manufacturers, and adopted sizes which differed but little from the average that had been in use and which we thought would answer our purpose best. In the matter of number of bolts especially, we tried to fix the same for each flange so as to have bolt holes spaced as nearly as possible the same distance, about 6 inches. This is fully ample for our purposes, although it may not answer for high pressure steam or water.

All of the above mentioned manufacturers of pipe and specials in the East were then communicated with, and invited to join with us in putting our scheme into practical operation. They all replied favorably, excepting the Warren Foundry. The McNeal Pipe and Foundry Company, the predecessor of the United States Cast Iron Pipe and Foundry Company, were especially cordial in their acceptance, as per their letter of February 18th, 1892. Several other Gas Associations have adopted our scheme, and several manufacturers have actually altered their stock patterns to conform with it.

It seems, therefore, rather late in the day to throw our standard overboard and adopt another. What we were aiming for was to have only one standard flange in use at our works, so that in making alterations, extensions and additions everything would come in all right without question or extra labor.

If we were to abandon ours for the Steam Fitters' Standard, we would practically nullify the work done by us for the past 8 years.

We feel that the gas business is sufficiently large and important to stand on its own feet. Our requirements are somewhat different from those of steam and water plants. The only thing necessary is to have our members insist upon getting our standard castings when giving out new work. The manufacturers then will quite readily furnish them. Competition will bring prices down to the proper figure, no matter whether they have drill heads for other standards or not.

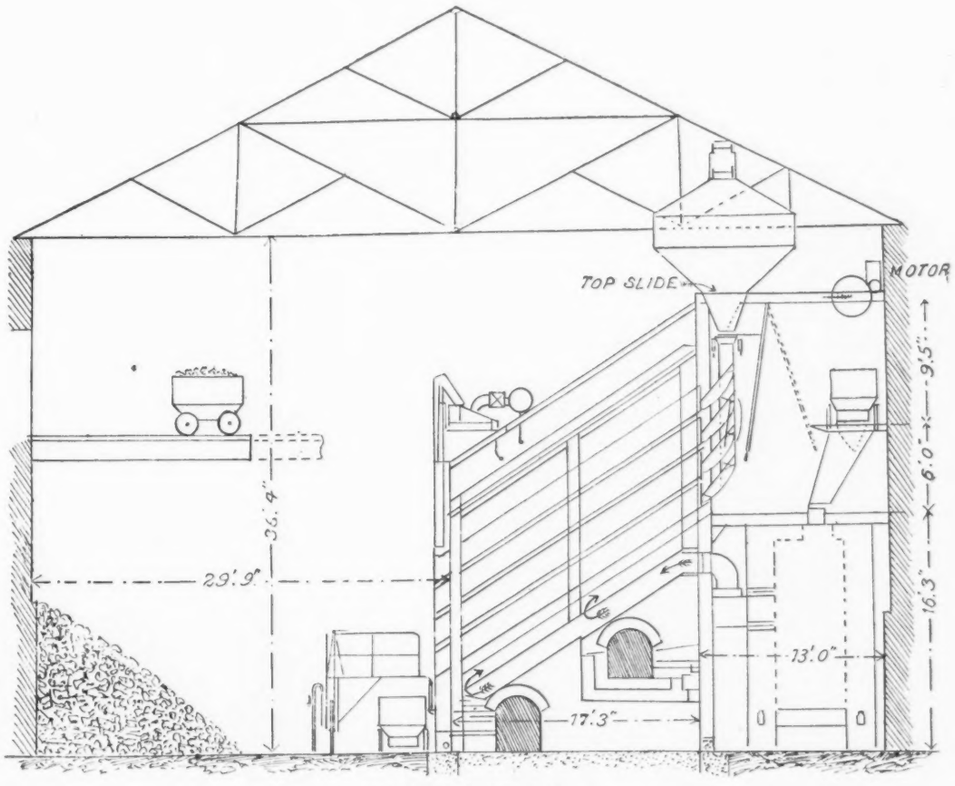
We, therefore, recommend to stick to our standard.

(Signed) ALEX. H. STRECKER, ALTEN S. MILLER, ALFRED E. FORSTALL, } Committee.

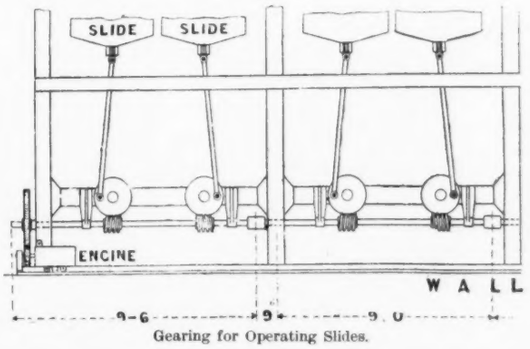
Inclined Retorts at the Bankside Works of the South Metropolitan Gas Company, London, England.

[A paper prepared[1] for the Tenth Annual Meeting of the Institution of Gas Engineers, by MR. C. C. CARPENTER.]

Bankside are the smallest works of the South Metropolitan Gas Company, their output being from 1,750,000 to 2,000,000 cubic feet per day. They are worked for six months of the year at their full capacity and for six months at half. Their size and absence of disturbance from "lighting up" or "letting down" render them extremely suitable as experimental works, for which purpose they have been considerably used. In 1896 it became necessary to consider in what form the retort benches should be renewed during the following summer. The alternatives were of course stoking machinery or inclined retorts. Several installations of the former had been applied at various of the Company's works, and their mechanical and gas making efficiencies were thoroughly known. On the other hand, the only sloping retorts were in practical working in conjunction with horizontal ones, and it was possible to differentiate their efficiency during testing periods only.



Inclined Retorts at Bankside.



Gearing for Operating Slides.

Somewhere about this time Mr. James Husband, who, with Mr. Frank Morris, made a good deal of the English history of inclined retorts at their Brentford and Southall works, gave the author several opportunities for inspecting their plant both in its early and late stages and in course of its construction. The author takes this opportunity of expressing to both these gentlemen his thanks for the kindness and courtesy with which their works and working were invariably opened to his investigation. He saw various kinds of coal operated, large and small, dry and damp, and in the end came to the conclusion that he could equally make inclined retorts a success, and therefore recommended their adoption at Bankside. The retort house was an old one built by the Phœnix Company, in 1840. At some time or other in its history the retort benches had expanded horizontally and laterally and thrust the walls out of the upright, distorting to some extent the roof principles also. In substituting inclined for horizontal retorts, therefore, one of two courses was open, either to pull down the house to the ground level and rebuild it with a new roof, or to design the retorts to fit the existing building as it stood. The latter course was adopted, and explains certain characteristics of the arrangement. The general outlines are shown in the cartoons, and in explaining these the author proposes to state briefly the reasons for the adoption of the various details.

The setting is of eight retorts, four high, in two vertical rows. It was not possible to make the setting a complete "Imperial" one, owing to lack of necessary head room. The author, therefore, had to be content with four superposed retorts instead of five. The retorts are 20 feet long and provided with one 6-inch ascension pipe at one (the lower) end. The late Mr. John Methven for many years worked his horizontal retorts at Nine Elms under similar conditions, while his make and quantity of gas per ton was among the highest in his Company. These facts were considered by the author sufficient justification for the dimensions he adopted. Having determined the length, it became necessary to consider the shape and size of the retorts. In many cases these have been made taper to facilitate discharging, four inches in 20 feet being not an uncommon amount. This is, however, but one in 60, or one-fifth inch to the foot, and it appeared to the author that, having regard to the distortion and cracking of retorts by use, such a variation from parallel could not be of much moment either way. On the other hand, several disturbing conditions are introduced by using taper retorts. In the first place, it cannot be so easy to make a true taper retort as a true parallel one, and the latter can be made a better job of in setting. But the more important condition is that a set of taper charges in the retorts of the setting should mean a set of "taper" heats, surely a retrograde step in the proper carbonizing of coals, even if such a re-

1. In the absence of the author the paper was read by the Secretary.

quirement was easy of attainment, which compared with uniformity it is not. Parallel retorts were, therefore, decided upon, and the author has no reason to regret his choice. The retorts are a modified D shape, the minimum of radius being given to the lower corners. The sides are vertical, in order that the charge, as it is carbonized, may freely rise and not jamb against the crown in discharging. As it would (nominally) be unnecessary to use stoking tools there was no occasion to leave more room above the charge than was required for the passage of the evolved gas. The space, therefore, could be reduced to a minimum and the time of "rest" for the gas in the retort largely reduced. The retorts are 24 inches wide, sides 7 inches high, rise of crown 6 inches. They are set at an angle of 32°.

The setting itself is completely divided by a middle wall into two complete independent settings. The credit for this arrangement belongs, the author believes, to Messrs. Morris and Husband, and is a ready means of adjusting the heat requirements either of the upper or lower portions. At Brentford this was attained by leaving an opening in the middle wall, which could be increased or reduced at will by the use of tiles or bricks, thus admitting more or less heat to the upper end, as might be required. The middle wall in the Bankside settings is solid, no arrangement having been made or found necessary for regulation of the heat. The inclined gas flue from the producer, returns upwards again from its lowermost point, and is provided with two openings which supply gas to the lower end of each gas flue in which the nostrils are formed. These are all of one size, as are also the ports supplying them with secondary air. All the regulation, therefore, that is possible is obtained by the four exit dampers at each corner of the setting. It is found in practice that with such an arrangement of flues none other is required. The secondary air heating flues are formed in steps, each of which carries one of the cross walls. These cross walls are made of 9 inch bricks laid to the retort angle and to 15 inch centers. For this arrangement of air heating flues the author is indebted to the ingenuity of Mr. John Brown, his foreman retort setter, who suggested it as a more stable foundation for the retorts than the sloping flues originally contemplated. There are two main flues and two shafts. The former are a convenient means of reducing the quantity of brickwork below the floor line. The dampers and secondary air shutters are conveniently arranged for access and cleaning. Each producer supplies gas to three settings, *i. e.*, 48 mouthpieces. The producers occupy the space under the charging stage, which forms a very convenient position. They are quite independent from the retort benches, to which they supply their gas by means of cast iron 18 inch pipes. Butterfly valves are provided to check the draught when the doors are open for clinkering. The charging doors are 19 feet 6 inches above the ground working floor. The takeoff pipe can therefore be fixed a considerable distance below the upper part of the producer, and this space forms a hopper for the cold fuel, which automatically falls, and keeps the fuel bed at one level between the periods of charging. No cold air is admitted during this operation. All the coke required for the producer has to be raised from the ground floor to the producer mouth level. To this disadvantage there are several sets-off, apart from the fact that, with the house in question, owing to the limited head room, no other arrangement was possible. The weight of coal carbonized is ten times that of the fuel put into the producer. To charge the latter by gravitation would necessitate lifting the whole of the raw material a sufficiently greater height to allow one-tenth of it in the form of coke to fall into the producer. The author uses a hydraulic wagon lift as a substitute. The working costs are set out in the table.

The coal charging shoots are arranged after the Brentford pattern—*i. e.*, the measuring chamber is fixed at such a height above the top retort as to give sufficient fall with the worst description of coal used. With "livelier" coals, and for the lower retorts, a flap check is provided in each shoot, actuated by a lever fixed to either end of a spindle on which it is mounted, working in a quadrant, by which it may be set at will to afford any "check" or "baffle" required. With any kind of coal it is easy to lay a perfectly level charge in any retort by these means. In order that the flow of the coal stream from the measuring chamber to the retort should be regular and uniform, the widths of the slide or door opening and of the shoot were all kept the full width of the retort, namely, 24 inches. Only the lower door of the measuring chamber is operated by hand, and therefore under control of the stoker. The upper doors are attached by means of a long rod to a crank pin fixed to give the required stroke on a worm wheel which is placed opposite. The worm wheels are in right and left-handed pairs, driven off corresponding worms keyed upon a longitudinal shaft running the length of the bench. As the worms are in right and left handed pairs, they balance one another, and produce no end thrust, so that the entire set of doors is easily operated simultaneously by one of Messrs. West & Company's smallest size motors. As a complete revolution of the worm wheel must be made at every operation, each measuring chamber must always be entirely filled for each charge.

The coal is brought into the retort house by an overhead railway, shot into the breaker, elevated and conveyed to the overhead continuous hoppers in the usual way. The railway, by means of a turntable, is in connection with lines running at right angles, along which run the coke wagons which feed the producers.

These runs also serve the purpose of affording the "charging" stokers what access is required by the two upper rows of retorts, the two lower ones being reached, of course, from the stage. At the discharging end the bottom row of mouthpieces are worked entirely from the ground, the three upper ones from a light trolley, the wheels of which run on metals kept clear of the coke heaps made during each "draw." The expense of a second stage is thus obviated. The coke is quenched and thrown back against the retort house wall, where it forms a store, from which it is loaded into vans or carts as required.

As only one hydraulic main is used, it is made with double the usual area at the liquor level. The tar is taken off from the bottom in the manner now usual. The hydraulic mains are made in single lengths, carried, as are the foul mains, from the diagonal H-iron tie.

The foregoing is a brief description of the Bankside plant; some details of its working must now be given. The first three settings were put to work in February, 1898, the remainder of the nine benches (forming half the retort house) two or three months later. At this time one-half of the retorts in use still consisted of the old horizontal pattern. With the new inclined retorts high and regular heats were obtained, and charges averaging 6½ cwts. to 7 cwts. were worked off with ease. The make of gas per ton fell off, however, instead of gaining, as is generally the case when a new set of retorts is put into action. It was assumed that the fault lay with the old section of horizontals, the renewal of which was considerably overdue. The drawing and charging of the inclined promised well, and therefore the material for the second section was ordered in order to complete the house. To proceed with this work the horizontal retorts were put out of action and the work of demolition proceeded with. But the make of gas per ton of coal was generally less instead of better; week by week, month by month, went by, and the search was unremitting of those concerned for the missing gas. One Sunday was given up to testing the station meter. Then another for the soundness of the various valves. Then the by-pass was taken out and sealed up, then the washing and purifying plant put under pressure and tested for soundness with a blower and meter. Observations were made to see if the make of gas fell when one or the other washing or purifying vessels was shut off for changing; the mains and connections were also cleared and examined. The hydraulic seal was varied and the retort house vacuum altered, but without improvement. All this time coals had been taken as usual from the Durham deliveries, and week by week the coal stock was anxiously taken. Sometimes the make of gas per ton would be a little over 9,000 cubic feet, sometimes below. Meanwhile earnest and continued attention was given to the retort house. The pressures in the bottom mouthpieces and in the top ones, in the ascension pipes, the arch pipes, dip pipes and hydraulic mains were tested in all ways, but without throwing light on the cause of the trouble. Two observations stood out, however, beyond the others. One was that the retorts scurfed so rapidly that they had to stand off at no greater interval than once in three weeks. The other was that the irregularities in the thickness of the charges could not be laid at the door of any particular men. With the best of men sometimes matters went all right and at another as wrong.

About this time too, the suggestion was made that the heats were so good that the charges were slipping down in consequence. Since coal would rest in a cold retort, even if it slipped in a very hot one, it was argued that improvement would be attained by working nearer to that limit. It was thought, too that the irregular shutting of the doors produced the same effect, for charges which were watched and noted as being perfectly level were, when slacked out for drawing, found to completely fill the bottom of the retort. The appearance of charges was then noted by leaving the upper lid unclosed, and though perfectly level at first, yet in a period varying from 10 seconds to a minute or two, it was found that the coal had slipped down until it had risen to the crown of the retort. Here, then, was the clue to the mystery, that no matter how carefully the coal was laid, in the process of burning off it slid down to the lower extremity of the retort. The next step forward was to trace this effect to certain kinds of coal, which were diverted from Bankside, and a selection made of those varieties which gave no trouble in this respect. The result was most marked. The

make of gas rose to about 10,300 per ton, and has remained at about this figure since. For the purpose of this paper trials were made with four of the principal descriptions of coals wrought in the Durham district and used by the South Metropolitan Gas Company. Each kind was used for two or three days prior to commencing the trial so that all the conditions might previously become nominal.

Kind of Coal.	Gas per Ton at 30" and 60°.	Coke Sold.
A	10,392 cubic feet.	10.4 cwt. per ton.
B	8,736 "	10.9 "
C	9,093 "	11.0 "
D	9,420 "	10.6 "

Each experiment consisted in carbonizing about 1,000 tons of coal. The above coals produce in average working with horizontal retorts from 10,200 to 10,600 cubic feet per ton. The whole of the difference in working is that when carbonizing A quality the charges remain where placed; with B, C and D they slipped while being worked off. The weight of charge and the heats worked were identical within practical limits.

Only one defect made itself apparent in the plant. It was important and deserves notice. The coal conveyor above the continuous hopper, as originally arranged, worked between two angle-iron guides placed about 10 inches apart and running the entire length of the hoppers. The coal as conveyed fell through the space between, making its own angle, and as it piled up formed the continually extending bed along which the successive portions were scraped. If the quality or condition of the coal supplied to this conveyor varied during the process of filling the hopper it would be arranged therein in an inclined stratified condition, the extent of each stratum being the angle of repose of the coal in the hopper, or only a few feet horizontally. So that if there were four changes of coal during the operation of filling the hopper, the first portion would have one quality, the second another, the third another, and so on. The retorts are charged in horizontal order, and under the above conditions four charges of coal might be used in operating but one row, and the shoot baffles, after having once set, would require two or three alterations and adjustments in traveling from end to end. This proved in practice a considerable disadvantage, but it was easily overcome by closing the bottom of the coal conveyor and making a series of openings provided with adjustable slides. These regulate the amount of coal and distribute it pretty evenly in *horizontal* strata in the hopper, so that whatever adjustment is needed of the charging shoot it is maintained row by row.

The cost of working the bench of 144 retorts per 24 hours is as follows, working 6 hour charges of 6 cwts. = 173 tons per day:

Chargers	8 men at	7s. 1d.	11.19d. per ton.	
Drawers	8 "	7s. 1d.		
Coke trimmers and quenchers	8 "	6s.		
Filling furnaces	4 "	6s.	3.63d. "	
Clinkering	2 "	7s. 1d.		
Emptying pans and wheeling out	2 "	7s. 1d.		
Screening and picking	2 "	7s. 1d.	.98d. "	
Coal breaker and elevator	2 "	6s.	.83d. "	
Mains and pipes	1 "	6s. 2d.	.43d. "	

The entire installation cost from the floor line slightly under £14,400, or £100 per 20 foot retort.

Analyses of the producer gases are appended:

Analysis of Producer Gases.

Test.	Percentage of Volume. CO	CO_2	H
1	26 0	6.0	8.4
2	26.4	4.0	8.0
3	25.2	6.0	7.8
4	25 6	4.8	7.4
5	26.4	4.2	8.4
6	25.6	5.0	8.6
7	25.2	5.6	7.4
Average	25.8	5.1	8.0

Discussion.

Mr. W. R. Herring observed that one felt considerable disadvantage in discussing a paper of this sort in the absence of the author, and personally he intended to criticize it somewhat severely, which might look like taking advantage of a man in his absence, and he would, therefore, have liked that Mr. Carpenter should have been present to answer his criticisms. At the outset, his first impression of the paper was that it was a very elementary treatise on a subject which was now fast becoming old. Mr. Carpenter had certainly traversed a good deal of ancient history, and he appeared to have accomplished in 1898 what had been done a great many years before, and had adopted a model which certainly did not possess all the advantages which were exhibited by the system as in use in different parts of the country. Mr. Carpenter gave the general outline of the settings, which he spoke of as being settings of eight in four tiers, and that was a matter he would particularly have liked to discuss with him, as he considered it an open question whether they could not go higher with their retorts; he would have liked particularly also to have got from him why he did not adopt settings of nine. Settings of nine must, he thought, necessarily be cheaper than settings of eight. Then with four rows they could have a setting of twelve, instead of a setting of eight. Nine retorts was a common setting on the Continent, and he had never put up anything else himself, and it was quite easy to construct them so as to get rather less heat in the center middle retort than in the other part of the setting. Mr. Carpenter appeared to infer that a single 6-inch ascension pipe was not the general thing, but he (Mr. Herring) did not know of any setting of inclined retorts that had two ascension pipes; in fact, where they had two ascension pipes in a horizontal setting it was always a question whether they worked together. They could not have exactly the same pull on the opposite sides of a bench of retorts, and it would generally be found that one pipe only was taking away the gas. Whether 6 inches was the proper size for the ascension pipe was another question, and he thought the larger these pipes were the better. Then Mr. Carpenter raised a very important question as to the shape and size of the retorts, and he spoke of taper retorts. He had himself had considerable experience with both shapes of retorts for inclined settings, first with the parallel and then with the taper, and he was inclined to agree with Mr. Carpenter that the advantage of the taper retort was not so great as appeared on the face of it. The question of exact design and cross-section was far more important, and Mr. Carpenter had hit the mark very nearly in adopting vertical sides and carrying them sufficiently high to prevent the coal jambing in the crown of the retort. He disagreed with Mr. Carpenter as to the difficulty of making a taper retort, as he knew of machines which could make them beautifully, but he agreed with him that they were not the advantage that was at first anticipated. With regard to the construction of the setting, Mr. Carpenter gave credit to Messrs. Morris and Husband for dividing the setting with a single, solid, middle wall, but he really did not think that Mr. Carpenter could have been serious when he wrote that, as he (Mr. Herring) knew of no settings of retorts that had been constructed without a solid center wall of the kind. That, therefore, must have been a slip on Mr. Carpenter's part. In regard to the following passage he was not sure whether he had understood Mr. Carpenter correctly: "For this arrangement of air heating flues, the author is indebted to the ingenuity of Mr. John Brown, his foreman retort setter, who suggested it as a more stable foundation for the retorts than the sloping flues originally contemplated." He was not quite sure whether it was to be inferred from this that the brickwork was usually laid at the angle of the retorts. While this might have been done in some of the early settings, there was none, certainly within the last seven or eight years to his knowledge, where the brickwork had not been kept entirely horizontal. As far as possible the brickwork should be kept entirely on the horizontal line to the coping, and the side wall stepped out to meet the receding brickwork to bring about the angle. An important question was raised as to the producer, but one could scarcely see how the construction of these beehive producers could be any cheaper, if as cheap, as the construction of the necessary number of independent furnaces beneath the sloping parts of the retorts. Although Mr. Carpenter had admitted the necessity of saving brickwork he had a tremendous amount of solid brickwork. In addition, he had all this huge construction lying underneath the charging stage, which must help to warm it up for the men and make it uncomfortable. He, for one, would be very glad to have an exact estimate of the cost of working the outside producer as against the inside producer. Then, again, the outside producer necessitated the elevation of the coke. He did not see that Mr Carpenter's structural conditions led him to have the stage floor in the front. He could have adopted this system of producer and still charged it in the automatic way by taking the coke from the mouthpiece. With regard to the arrangement of worm gear for moving the slides, they all knew that, from an economical point of view, a worm and-worm wheel cost more, weight for weight, to manufacture than a silver watch, and why all this unnecessary mechanism had been introduced to move those slides, which were usually moved by a lever from the stage, he could not conceive. It was introducing unnecessary mechanical complication into a process which was intended to be used without mechanical complication, and one would have liked to have got from Mr. Carpenter personally what was his line of thought, or what was his object, in

adopting that mechanical device, when the work could easily have been done by a mere stroke of the lever. With reference to the question of slipping, Mr. Carpenter appeared to have overcome that as everybody else had done, viz., by mixing a coal that slipped with coal that did not.

Mr. F. D. Marshall said he thought they were all sorry Mr. Carpenter was not present, and he himself was particularly so, because some few years ago, when he read a paper on the same subject, Mr. Carpenter had a great deal to say and he would like Mr. Carpenter now to hear what he had to say on the paper. As to the taper retort, he pointed out some few years ago that it did not possess any advantage at all. In his own experiments, made 12 years ago, he tried taper retorts. The idea was, of course, to stop radiation from the top doors, which was very great, as they all knew, but they found that they could not get the amount of coal into the top portion, and as heat had, of course, a tendency to rise, they found they had over carbonization at the top and less carbonization at the bottom. So they gave up the taper retorts in each case and had the larger doors, so that the question of the taper retorts was really flogging a dead horse. There was another point he would like to mention, and that was as to the cross wall. It had always been a debatable point why they wanted a cross wall in the center of the setting; he had himself put up settings of 17 feet and they worked very well without the cross wall. He knew that Mr. Morris had a great deal of trouble in getting the heats distributed, because there was a tendency to rush to the other end; but he thought he might have got through without putting up a cross wall; at all events that was his opinion. Mr. Carpenter preferred to put his main flue inside the setting, but after a few years' experience they had come to the conclusion on the Continent that outside was the best place for the flue. In his opinion it was a source of weakness to have the flue inside the setting—to have a hollow tube running through the longitudinal section was a great source of weakness, and he did not see that there was any saving of expense, while if the flue came outside the stability of the structure was thereby greatly enhanced. But the question of the flue was also a very debatable one; personally, he thought that the outside was the place for it. As to the slipping of the coal, that was a serious matter for all. He had made many experiments in connection with that, and he had found that the slipping was due principally to the fine coal—coal that was put into the retort in a very dusty condition. He had found that gas making commenced immediately the coal touched the heated surface of the retort, and the gas arising from the fine coal was able to push itself through this compact mass and to raise it up in small volcanoes, so that they got a series of hunks over the whole of the surface of the coal, and these gases continually bubbling up through the mass of coal had a tendency to set the whole mass in motion. He had got over that trouble, not by using different coal, but by using the coal in the best possible condition. Instead of putting the whole bulk of the coal into the crusher they had let as much as possible go into the screen itself, so that they only crushed the very large pieces. By putting the coal into the retort as large as possible it was found that slipping was obviated. If they had to adopt one particular description of coal for the retorts, that would be a very bad case, because the owners of the coal would be able to demand very excessive prices. The slipping was really a question of the fineness of the coal put into the retorts. He would like very much if Mr. Herring would tackle the question of the cost of manufacture in inclined retorts.

Mr. Herring—I take it that these figures are for 12 hours.

Mr. Marshall said the figures were rather vague, and he would also like it to be explained why Mr. Carpenter should have put these retorts in settings of 8 instead of 9. Taking the settings as a whole, he considered that they showed a lack of originality, and that members of the Institution would be making a retrograde movement in following what was shown in the paper.

Mr. R. Brown, Cambridge, agreed with the previous speakers that it was difficult to discuss an important paper of this description in the absence of the author, because it was like stabbing a man in the back. With regard to the taper retort, he thought there was nothing whatever in it, and that they would do just as well by having retorts of the same diameter throughout as by going to the expense of taper retorts. It was said that with taper retorts they could get the coke out somewhat better. It might be that they could do so at the start, but after the taper retorts had been worn a little the coke would require as much tickling to bring it out as in the case of the straight retorts. Mr. Carpenter then went on to state that he found very great reduction in the amount of gas per ton of coal, and to speak of the increased necessity for scurfing, but it seemed to him that he could not possibly have been running his exhauster with sufficient vacuum, or he must have been working with a very heavy seal. In his own case they had nothing of that sort to put up with. If they scurfed once in three months it was as much as they ever thought of doing, and no more scurfing was required with inclined retorts than with horizontal. The coals they used were Yorkshire coals. As to the creeping, he did not think there was so much in it as it had been sought to be made out, and that it was one of the bogies which had been put forward by the opponents of this system. In his own case he had never had any difficulty whatever with regard to the creeping of coals, but rather the other way. In fact he had found a difficulty in getting the coals to the bottom of the retorts, but he had got over it now. He would also like to ask Mr. Carpenter a question about the depreciation in illuminating power. That, he believed was another of these numerous bogies which had nothing whatever in it. He had an opportunity last summer of working inclined retorts, and he was able then to send out gas with an illuminating power of 16½ candles without any enrichment whatever. There was no doubt that some kind of coals had answered better than others with inclined retorts, but as had been said by previous speakers, if they knew which coals suited the inclined system there was no difficulty with these creeping. For his own part he could not speak too highly of the system of inclined retorts, more especially for works of the size of which he had the management, and he thought that at the present time, when coal owners were putting their hands so freely into the pockets of gas companies, they should look as much as possible to the decreased cost of production. To his mind the best way of decreasing the cost of production was to go in for inclined retorts, which was the most economical and convenient system of the present day.

Mr. S. Meunier, Stockport, said he was glad to hear the expression of opinion with regard to inclined retorts. When he first glanced at the paper he began to think that the step he had in view was a retrograde one. They had a certain amount of room in a retort house in which the output had not been what it ought to be, and he was particularly anxious to try and increase it, and he had had it in mind that it might possibly be done by the use of inclined retorts. But when he came to the figures given in the paper as against his own actual working of horizontals, he began to think that he had been making a mistake. With eight retorts in a setting, 20 feet long, 24 inches wide, and 30 inches deep, Mr. Carpenter only carbonized 9 tons 12 cwts. in the 24 hours, whereas with retorts an inch narrower, and of the same length, but rather higher, he had no difficulty in carbonizing 11 tons. Then, as to the question of cost, he was rather struck some time ago with what Mr. Carpenter said with regard to having one generator for a number of settings, and he had also taken that into consideration, but he would like some explanation from Mr. Carpenter as to how it was that the cost of clinkering appeared to be high, namely, 3.63d. Even with the wages paid in the southern districts, that appeared to him to be unreasonably high, because with a single generator they could get it done for 2d. Probably they did not pay quite as much to the men per day, but still the difference between the two surely would not amount to nearly double. He would be glad to have an explanation about that.

Mr. C. E. Brackenbury, London, said that one remark occurred to him in reading the paper, that it was called "Inclined Retorts at Bankside," whereas on the agenda paper that the members had received, it was merely described as a paper on inclined retorts, and he had been led to suppose that Mr. Carpenter was going to give them a general view of the present position of this system of carbonizing in this country, and it was much to be regretted that instead of their having the opportunity of discussing several points of importance which were still open to be discussed, they had only a description of what had been described by every speaker, so far, as a retrograde movement. He did not think that the present paper would tend to remove or even diminish the generally accepted opinion that London gas engineers still lagged very much behind their professional brethren in the provinces and on the Continent in this matter of inclined retorts. Mr. Carpenter had given credit to certain gentlemen for being the first to favor inclined retorts in this country, but it should not be forgotten that there were others who were just as well entitled to be considered as pioneers. He would like to ask Mr. Carpenter what steps he took before putting up this Bankside installation, and what installations in the provinces he had visited, so that they might know what guided him in putting up such an installation. They would notice that the retort house adapted was an old one, dating back to 1840, and described as being in a decrepit state and faulty in respect of roofing, and no doubt 99 engineers out of 100 would have said "pull down your house and build a new one especially adapted to the plant you are going to put in." Instead of that, however, eight retorts were put in instead of ten or nine, and

and there was also the considerable drawback of there being only one stage instead of two. But, as had already been said, this was ancient history, because he believed that Mr. Herring, at Huddersfield, in 1892, adopted a similar arrangement, and as that arrangement was not extended it might be taken that it was not sufficiently successful to justify extension. The use of one ascension pipe was, of course, many years old. With regard to the taper retorts, he had had nothing to do with any inclined retorts that had been tapered, but those inclined retorts which he had had to do with had given full satisfaction as regarded the facility—to some extent that might be somewhat theoretical—for the discharge of the coke, and he remembered that at Newcastle-under-Lyne in 1894 a retort was built 16 feet long having a taper of 1 in 32 as compared with Mr. Carpenter's 1 in 60, and that retort was reported on very favorably. There seemed to be some inconsistency with regard to these taper retorts, because Mr. Carpenter remarked that such a variation could not be of much moment either way. That was in connection with the drawing of the charge ; and in the paragraph which immediately followed Mr. Carpenter argued that tapering charges would mean a set of taper heat, so that it seemed to him that Mr. Carpenter was trying to get the advantage both ways. Although it might be theoretically correct that they should have tapering heats where they had tapering retorts it was one of those theoretical things which were of no consequence whatever in actual practice. The measuring chambers were certainly something beyond comprehension, and why Mr. Carpenter should go to all the trouble of having worm gear for the purpose of opening the top doors of the measuring chamber simultaneously, so as to destroy at one blow all the effect of the charging apparatus, he could not see. He understood that all the measuring chambers were filled simultaneously through the gearing, and that if they wanted, through any retort having dropped out of its ordinary rotation of charging, to charge a retort and the measuring chamber happened to be empty, they would have to put into motion all the gearing to fill one measuring chamber. It puzzled one to find out what compensation there was in an arrangement of that nature, and why the usual arrangement should not be adopted of connecting the two slides with a single lever so as to make the whole operation independent to a great extent. Mr. Carpenter spoke of the difficulties which had been experienced in working this installation from the fact that the metals had to be kept clear of the coke made during each draw, and one could easily understand with such an arrangement how careful one must be, and what a tremendous amount of labor and money must be spent in keeping the rails clean, so as to facilitate the passage of the workmen. And though by such an arrangement the expense of a second stage was obviated, it must be remembered that the economical advantages of the second stage were also obviated. As everybody was agreed, this going back to a single stage house was such a retrograde movement that it was hardly worth troubling about. As to the differences in coals, the net results of the paper seemed to be that out of four kinds of Durham coal, Mr. Carpenter had found one that he could use in inclined retorts. In the works he himself was connected with they used nothing but Durham coal of the finest quality, and possibly it was of such a fineness as was not generally seen in this country, owing to its transhipment. They used nearly all the kinds of Durham coal that there were, and in not a single instance in the three different arrangements of inclined retorts that they had, had they the smallest trouble from the slipping of the coal.

Mr. T. S. Lacey observed that the length of the retort was a very important question, and he understood that Mr. Brackenbury was making a comparison of a 15 feet retort with the 20 feet retort mentioned in the paper.

Mr. Brackenbury said he had always understood that the slipping of coal depended on the angle and nature of the coal, and therefore it was a matter to a certain extent of the utmost indifference whether the length of the retort was 15 feet or 20 feet, and the general length of the retort on the Continent was 15 feet. Mr. Carpenter used a quality of coal giving 10,400 cubic feet of gas per ton, whereas the coals which he made use of on the Continent gave an average make in the inclined retorts of 10,600 cubic feet. It was very difficult to make out from Mr. Carpenter's paper whether he considered the inclined retorts a success or not, and he hoped that Mr. Carpenter would very soon have another opportunity of putting before them his views on inclined retorts, after having had experience in a house specially built for any arrangement he might think it best to put up.

Mr. Marshall observed that in his experience the length of the retort had nothing to do with the slipping.

Mr. J. Tysoe, East Greenwich, said he did not propose to enter into a general discussion on this paper, or of the subject, with which he was not practically acquainted, but he might perhaps remark that this installation of inclined retorts had been very successful in its results, from what he knew of it. Previous to the introduction of the inclined retorts he might say that Bankside was one of the dearest of the Company's stations in carbonizing wages, and it was now almost the cheapest. That was owing to the introduction of inclined retorts, and he thought great credit was due to Mr. Carpenter for the way in which he had carried out the work. Very great difficulties had to be encountered by him, difficulties which were almost insurmountable ; but he tackled the whole matter in a very plucky way, and he had been successful throughout, and had brought the experiments to a successful issue, as was proved by the results. The only point in the paper which he wished to take notice of was in regard to cost It was not often that they got authentic statements of the cost of working inclined retorts. This was a matter that he had been working at for some considerable time, but he could get no figures which it was possible to compare with stoking by machinery. The figures in the paper might, he believed, be accepted as correct. There were champions of inclined retorts present, and gentlemen who knew all about the working, and no statement had been made calling in question the figures given in the paper, so that he took it that these were such figures as generally obtained where inclined retorts were worked. He had taken the trouble to take out his own figures with regard to the cost of carbonizing by machinery, thinking that it might be of interest to make a comparison between the two. Mr. Carpenter's figures amounted to 16.08d. per ton of coal carbonized, and the cost of stoking by machinery in his own works, taking precisely the same figures as were given by Mr. Carpenter, and working, he might say, in the same fashion and under circumstances practically identical, amounted to 11.91d. per ton, as compared with Mr. Carpenter's 16.08d. He would make a present of the odd figures and call it roughly 1s. against 1.6d. Those figures spoke for themselves, and the members of the Institution would be able to draw their own conclusions from them. The cost of inclined retorts as given in the paper was £100 per 20 foot retort, and that, he believed, as far as he had been able to ascertain, was about the usual cost of an inclined installation. He again took his own cost for the same work, including stage flooring, the setting itself, and everything connected with it, everything, in fact, apart from the building itself, and including the machinery necessary for working the retorts, and the cost amounted to £75 per 20-foot retort, so that he thought they had there a very clear enunciation of the fact that inclined retorts were not always superior to horizontal retorts worked by machinery. He had always held the opinion that horizontal retorts might be made to work out more cheaply with machinery than with inclined retorts, and he had seen nothing up to the present moment to cause him to alter his opinion. The figures in the paper would bear out what he had stated.

Mr. W. R. Herring pointed out that machinery must always be at a disadvantage if it could not be worked to its utmost capacity.

Mr. Tysoe said that, of course, was a *sine qua non*. The number of retorts done by one set of machines was 300—30 beds of tens, and the figures he had just given were based on the actual number of retorts in working.

Mr. Marshall said he thought that Mr. Tysoe had been rather unfair to those who had read papers on this subject before, inasmuch as he had said that he never before had a true statement of the cost of the working of inclined retorts. In the papers he had himself read on this subject he had always endeavored to give fairly and conscientiously a true statement of the cost, so that it was unfair for Mr. Tysoe to say that he had been unable to get a true statement. His own statement of the cost was 1s. 4d.

Mr. S. Y. Shoubridge observed that Mr. Carpenter had been rather severely criticized, and he was sorry he was not present to hear the criticism. The paper did not profess to set forth that this was an ideal installation of inclined retorts, but Mr. Carpenter had been good enough to say what he had done, and he thought they were quite as likely to learn from the mistakes as from the successes of other people. Whether Mr. Carpenter had made mistakes or not he had put his experience at their disposal, and therefore they ought to be exceedingly obliged to him for that. With reference to Mr. Tysoe's statement, that no one had given the cost of working inclined retorts, he would find that the total figures had been given in the case of Dewsbury, from the coal into the retort house to the coke into the yard, at 1s. 2d. per ton.

Mr. Tysoe explained that what he meant was that no figures had been given which could properly be compared with other figures, but in this paper they had figures which compared accurately with the figures of his own works. In the other cases figures had been introduced in a different way, and the accounts had been taken in a different way from that in which they were taken in his own case.

Mr. Shoubridge thought it hardly fair to compare the splendid installation of stoking machinery which Mr. Tysoe had at East Greenwich with the admittedly cramped arrangement at Bankside. A comparison should be made where the conditions were equal. The method of getting out coke, for instance, varied in almost every works, and the same remark applied to the means of getting in coal. With regard to the taper retorts, he would like to say, having been the first person to introduce taper retorts, that his experience had fully justified their introduction, and that they did facilitate the discharge of coke very considerably; therefore, Mr. Carpenter's assumption that they would not do so was incorrect. He thought that one reason perhaps why Mr. Carpenter had not attained to full success in his setting was that he had adopted small retorts, and another was that he had adopted a charging arrangement which was decidedly imperfect. Those two things together had been the main causes of the retorts not being a complete success.

The Empty Coal Cellar.

Iron Age says that about 20 years ago, an English philosopher and statistician, Professor Jevons, we believe, startled the British public by the assertion that the calamity of "an empty coal cellar" was imminent. After the first fright was over, public confidence returned quickly. The newspapers, while admitting in the abstract that there is a limit to all things, stoutly denied that the limit of England's coal was in sight, or that its exhaustion was anything more than a statistical prophecy, possible of realization at some time in the future so remote that, for the present generation, it had no more interest than the astronomical prediction of a gradual diminution of solar radiation. So the subject was dismissed. Now it comes up again in a shape which does not permit it to be brushed aside as an invention of the sensation mongers. England's coal supply is perceptibly diminishing, and the end of its available fuel resources can now be definitely calculated, if the present rate of consumption and export is maintained. A recent Parliamentary blue book, prepared by the Board of Trade at the request of the House of Commons, is extremely disquieting. It shows that the total exports from the United Kingdom amounted, in 1899, to 41,180,300 long tons, or 6,121,870 more than in the previous year. The purchasing countries have been arranged in groups. The greatest amount goes to European ports, including those on the Mediterranean. A small deduction should perhaps be made for the Channel Islands, Malta and Cyprus, and a larger one for places on the Asiatic and African shores. Subject to these allowances, which are probably less than 1,000,000 tons, European countries take from England about 36,000,000 tons, the export in 1899 exceeding that of the previous year by over 5,580,000 tons. There is an increase in every direction except one—viz., Northern and Central America, where the falling off is about 157,000 tons, the total quantity being well under 250,000 tons. That is not surprising, for both Canada and the United States have rich coal fields, some of which are well situated for their eastern ports. Europe, in fact, accounts for nearly seven-eighths of the total exports, Brazil, Uruguay and the Argentine States being the only other group of importance, and absorbing more than 2,250,000 tons.

To those so constituted that they look beyond the advantage of the moment, this steady and increasing drain upon the fuel resources of Great Britain is calculated to excite no little apprehension touching the industrial and commercial future of that country. How much coal remains in the undeveloped seams is, at best, a matter of estimate, but it is now well understood that all the coal "in sight" cannot be profitably recovered unless its value per ton is greatly increased. As greater depths are reached, the cost of pumping water becomes burdensome and finally prohibitory. This is also true of the expense of protecting the lives of miners. Increased temperatures at great depths render mining more difficult and costly. In Lancashire coal is now mined at a depth of 2,700 feet, and this level gives a constant temperature of 80° F. It will not be possible to go much deeper, since the costs of mining and lifting will make the product more expensive than it is worth. The question of checking the shipment of coal to foreign markets by the imposition of an export duty has already been discussed in Parliament, and is regarded with favor even by those who are opposed on principle to any restrictions upon international trade. The "empty coal cellar" is no longer a statistical possibility, but an unpleasantly imminent fact. Another five years, or at most ten, will, it is believed, see British coal enough more expensive than now at the pit mouth to represent a more or less serious handicap to British industry, and from being an exporter of coal England will become an importer, because coal can be brought from new fields cheaper than it can be mined in old ones.

Our own coal statistics are interesting. E. W. Parker, statistician of the United States Geological Survey, estimates the output of coal in the United States in 1899 at 258,539,656 long tons. As compared with the production in 1898, when the product amounted to 196,405,935 tons, this indicates an increase of 17.5 per cent. These figures exceed by 13,500,000 tons the outside estimates heretofore made on the coal tonnage for 1899. The production in 1898 was nearly 20,000,000 tons in excess of that in 1897, and both of these years were characterized by great activity in coal mining.

Perhaps the most interesting thought suggested by coal statistics is not, what will be the condition of the world when coal is practically exhausted, but what economic and political changes would result from taking the mining and selling of coal out of the hands of individuals and private corporations and making it what many think it should be—the business of the state for the benefit of the people. The obstacles in the way of this are not insuperable, even in this country, in view of the recent decision of the United States Supreme Court sustaining the State of Indiana, in denying the land owners the right to waste natural gas in order to recover petroleum at depths below the gas bearing strata. If they were insurmountable, however, there is nothing to hinder any government from imposing an export duty on coal so heavy as to be prohibitive. An international coal boycott would be a very serious matter for the nations without enough coal. It would quickly settle questions of industrial competition, and reduce to the position of very insignificant powers those not able to coal their own navies. It will probably be another century, even with the present enormous and rapidly increasing consumption, before coal is scarce enough to cripple industrial development, but long before that point is reached it may have become the duty of governments to take the coal business out of private hands, as a necessary measure of public policy, and to regulate mining, distribution and especially exportation with reference to home needs and local interests. This would set in motion new schemes of territorial acquisition by the great powers, and might lead to changes in the map of the world which could not now be predicted. To locate and acquire coal fields would be the objective point which would be the foreign policy of every power strong enough to protect itself, and those unsuccessful in the quest would have to make terms with their stronger or more fortunate competitors.

But there will come a time when the world's coal cellar, if not empty, will contain too little that is available to meet the necessary demands of even an economical consumption. What then? Science may find an answer for this question when an answer is demanded; but our present knowledge of nature's laws fails to offer any suggestion as to the means by which any important part of the work of coal can be performed by any other agency.

Prospecting for Petroleum in California.

Mr. A. S. Cooper, in Bulletin No. 16, California State Mining Bureau, writing on the topic named in the heading, says:

Surface indications of the presence of petroleum consist of unaltered rocks, white leached shales and sandstones, shales burnt to redness, fumaroles, mineral springs and the residue from mineral springs, such as selenite, subsidences, natural gas, springs of petroleum oil and maltha, porous rocks saturated with bitumen, cracks in shale and other rocks filled, or partly filled, with bitumen, black silicified shales. It would seem unnecessary to say that petroleum oil is not found in any notable quantity in metamorphic rocks, and if found at all that it is a secondary deposit. The prospector should confine his attention to unaltered rocks.

The color of the bitumens, when they exist near the surface of the earth, is black, bluish black, brown and dirty brown. Bitumen can be distinguished from coal, vegetable deposits, iron, manganese and other minerals that closely resemble them by the following tests: By its odor and taste; by melting in the flame of a match or candle with characteristic odor (iron and manganese do not fuse, and coal and vegetable matter burn without fusion); by dissolving in bisulphide of carbon, chloroform and turpentine.

It would be well, in prospecting for oil, to carry a small bottle of one of these solvents and another small bottle in which the substance to be determined is placed in a comminuted form and agitated. If a brown or black solution is formed, the substance under examination is bitumen. Iron, manganese, coal and vegetable matter are unaffected by these solvents.

All streams, pools and other bodies of water should be carefully inspected. If oil is present it will float on the surface, showing prismatic

colors. Compounds of iron floating on the surface of water frequently show these iridescent colors. Whether this scum is an oil or an iron compound can be determined by stirring the surface of the water with a circular motion. If iron, the scum will break into irregular fragments, and if oil it will form bands of color. In other words, the iron compound seems to act and break like a solid, whereas the oily scum acts like a liquid. Frequently gases are seen to ascend from the bottom of streams and pools of water. In the bed of La Brea Creek, upon the Sisquoc Ranch, Santa Barbara county, gases rise from the bottom of the creek for a distance exceeding 1 mile, which can be lit upon the surface of the water and burn with a luminous flame. This occurs in many other places in California.

Carburetted hydrogen, or natural gas, is a far greater indication of the presence of the bitumens than is sulphuretted hydrogen or carbonic acid gas; consequently, it is frequently important to determine between these gases. Carburetted hydrogen burns with a yellow, luminous flame, whereas sulphuretted hydrogen burns with a bluish flame. A familiar example of the color of these flames is shown in the burning of an ordinary match. Sulphuretted hydrogen has a strong odor and tarnishes silver. Carbonic acid gas does not burn or support combustion.

The following test papers should be obtained and kept dry and well protected both from air and light, in a small, wide mouthed bottle of dark glass: 1. Acetate of lead paper, which eventually becomes brown when exposed to gas containing sulphuretted hydrogen. If after an exposure of 10 minutes the paper does not become discolored, the gas may be considered free from sulphuretted hydrogen. 2. Blue litmus paper when moistened turns red on exposure to carbonic acid gas, or water highly charged with carbonic acid gas. The tests with the papers can be made as follows:

Procure an ordinary beer bottle of clear glass; run a red hot poker several times around the neck and near the bottom of the bottle; dip the bottle into cold water, when the bottle will break where the hot poker has been applied. Stop the bottle with a cork through which a small hole has been made. The test paper is suspended in the bottle by a wire fastened in the cork. Leave the hole open and hold the lower and open end of the bottle partially submerged in the water and over the bubbles of gas which are ascending through the water. If sulphuretted hydrogen or carbonic acid is present they will act in the manner described above on the respective test papers which are used to detect their presence. These papers will show the absence of sulphuretted hydrogen and carbonic acid gas, but where they are mixed with carburetted hydrogen the other test will have to be employed, such as the color of the flame when burning to determine whether carburetted hydrogen is present.

To make the test by the color of the flame, open the hole and submerge the entire bottle in the water; after the bottle is filled with water, close the hole and lift the bottle nearly out of the water; the bottle will remain full of water, on account of atmospheric pressure; hold open the end of the bottle over the ascending gas. When the water in the bottle is replaced by gas, sink the bottle nearly to its head in the water; the water will then press upon the gas. Open the hole and ignite the gas. If sulphuretted hydrogen is present, a green flame is seen; if carburetted hydrogen, a yellow luminous flame; if carbonic acid gas, the gas will not ignite; if these gases are mixed, the flame will be more or less yellow and luminous in proportion to the amount of carburetted hydrogen present.

If carburetted hydrogen is found it is nearly a certain sign that liquid bitumens exist somewhere in the formation, although they may be distant from the place where the gas issues.

All outcrops of the stratified rocks should be examined. There are generally better exposures of these rocks on the sides of the streams, canyons and gulches than elsewhere. The surface of the ground should also be examined. If any brown or black material is seen in the seams of the rocks or saturated porous strata, the described test for bitumens with solvents should be made. If natural gas or bitumen is found upon the surface of shale there is a strong probability that the bitumen has ascended vertically through these rocks from porous strata below, as the avenues for the migration of the bitumen are usually seams and cracks in the shale, the shale itself being impervious to the flow of the bitumens, especially the liquid ones. But when porous sand is reached, or when the outcrop is porous sand, it can be presumed that the bitumens reached the surface through the sand. Especially is this liable to be true of the sandstones standing at a high angle with the horizon.

Subsidences are indicative of the presence of petroleum, but if any oil is found in them it will be viscous and heavy, the fractured condition of the earth in the subsidence permitting the escape of the volatile parts of the oil. This is also true of burned shales, and if any petroleum exists in these shales it would be a secondary deposit, having entered the shales after they were burned. Petroleum vapor, in all probability, assisted in the burning of these shales.

As mineral water always accompanies the bitumens, mineral springs and the evidence of former mineral springs are to a limited extent evidence of the accumulations of the bitumens. Selenite, travertine, infusorial earth and a number of other mineral deposits are evidence of former mineral springs. When bitumens exist in a formation they are more often than otherwise overlaid with white leached shales and sandstones; therefore, these rocks are an indication of the bitumens to a certain extent, and, owing to their conspicuous color, can be seen from a long distance.

The Properties of Carbon in Electrical Work—I.

By Mr. Elihu Thomson, in *Electrical World.*

The elementary substance carbon bears such a unique relation to the electrical development in these later years that it may possibly be interesting to make this brief statement concerning those properties, both physical and chemical, which are especially valuable in this connection.

Since the discovery by Davy, almost at the opening of the present century, that the current of a powerful voltaic battery would after contact and separation of two electrodes of hard charcoal, maintain itself in a brilliant arch or arc of flame while a most intense light was radiated from the heated ends of the carbon, the interest in the phenomenon has been unabated. Though other conductors may yield similar arcs, the carbon arc has held the field in practice, and there is to-day no effective substitute for carbon even outside of the question of expense. The purer the carbon the more satisfactory the result.

Innumerable experiments with mixtures containing more or less carbon have been made, but none are of practical value. It is proper to inquire why carbon occupies the position that it does in electric arc work. I use the word carbon in this connection as indicating the black, compact variety, capable of conducting electricity. It is usually made from some carbon powder, such as ground petroleum coke or other nearly pure carbon residue, cemented by gas-pitch or tar, moulded into the form desired and finally baked or carbonized at a high temperature. This baking is continued for many hours and results in the loss of nearly all volatile matter.

The carbon rods or pencils so made have a moderate electric conductivity, $\frac{1}{200}$ or less as compared with copper, though this property varies widely with the density and manner of production of the particular specimen. The value of carbon for the electrodes of arc lights depends, first, upon its absolute infusibility and its high temperature of sublimation. It has never been melted and appears to be incapable, like arsenic, of existing in the liquid state at normal pressures. It could probably be melted if heated electrically under enormous pressures in an inert gas. Estimations of what pressure would be needed are of the order of 15 to 20 tons per square inch. It is conceivable that carbon may exist in great quantities in the liquid state within the bodies of some of the stars. In the electric arc the carbon at the positive pole or crater reaches its sublimation temperature, according to Violle, at about 3,500° C. The stream of carbon vapor evolved from the positive crater surface, in a normal arc in open air, is gradually oxidized into CO_2, which constantly escapes. If, however, the arc be too short, as when the carbons are not sufficiently separated, some of the carbon vapor fails to be burned in the flame, and is deposited upon the cooler negative carbon, giving rise to what are called mushroom growths of pure plumbago or soft graphite. The products of combustion of the carbon being colorless gases, they do not interfere with the evolution of light and practically no fumes are produced. The sublimation temperature is so high that light is most efficiently generated; about 10 per cent. of the heat energy is radiation consisting of luminous rays. Before the carbon is vaporized it is first converted into plumbago for a short distance from the extremity of the carbon rod at the arc. This fact led me, about twenty years ago, to propose the manufacture of artificial plumbago by passing heavy currents through slabs of agglomerated coke dust, shut in by a loose granular mass of coke for preventing radiation and loss of heat. In this way the temperature may be carried, even by a moderate rate of expenditure of energy, up to incipient sublimation of the slabs. This was, so far as I am aware, the first suggestion of electric furnace work in which no electric arc is formed. The carbon becomes plastic, as I found in some experiments made in 1882, and could, at the high temperature, be bent or shaped like fairly stiff clay. Recently the artificial production of graphite or plumbago from

anthracite coal or coke has been undertaken at Niagara, using processes worked out by Mr. Acheson, who discovered carborundum, and established the works for its production. Another valuable property of carbon which enhances its utility in electric arc work and also for electrodes of electric furnaces, is its low heat conduction. The efficiency of light production in the arc depends on keeping the heat produced by the current strictly local to the arc and ends of the carbons, or to those surfaces immediately concerned in light radiation.

If, as with metal electrodes, the heat was rapidly transferred along the length of the carbon pencil, much more energy would be required to keep the carbon up to sublimation temperature. In fact, I have known carbons to have been made, mistakenly, so hard and dense as to become relatively very inefficient for use in arc lighting. The only compensation was that they did not burn away so rapidly as those of more open texture.

And here we can recognize another valuable characteristic of carbon. Its state of agglomeration or its density may be widely varied and the electric conductivity remain sufficiently good in all cases. This property may be called its adjustability of resistance in relation to work for which it is needed.

The use of too large a diameter of carbon rod for the current in the arc has the same effect of conducting off the heat and lowering the efficiency, at the same time that there is the added detriment of hindering the radiation of light from the ends at the arc which are then more blunt and closer together.

Naturally, it was early recognized that the objection to carbon was its free combustion in air, and attempts were made, even as far back as the forties, to prevent this by exclusion of air. As often happens, however, the art was too young. The attempts generally failed from the presence of impurities, as iron and clay, in the carbon, giving rise to fumes which in escaping from the arc would soon obscure the surrounding inclosing globe and make it relatively opaque.

Within a few years past it has been possible to obtain carbons so pure and uniform that they could be used in a small glass inclosing vessel preventing free access of air to the hot carbon. A very great extension of arc lighting has followed in the use of what is known as the inclosed arc lamp. The chief objection to carbon was thus overcome. Carbons which before would only last in open air about eight hours may last 100 to 150 hours when inclosed. Enough oxygen must, however, even in this case be allowed to leak in to consume the sublimed carbon at the arc. Otherwise it may escape and go down upon the glass in a state of fine division, so obscuring the surface. The inclosed carbon arc is different in some respects from the open-air arc. The carbons burn with nearly flat ends of the full diameter of the carbon pencil. This requires a greater separation to let out the light freely, and in consequence a higher voltage to maintain a proper arc. This wider separation or longer arc is also required to prevent deposition of carbon on the negative carbon in the form of mushrooms or stalagmitic growths which would soon deform the electrode. It is easily seen that where the oxygen is deficient such a process would be much favored. The open air arc may be termed normal at 40 to 50 volts, while the inclosed arc demands 70 to 80—to sustain its longer flame. The combustion in the inclosed arc results in the production of carbon monoxide owing to deficiency of oxygen, but the combustion of the carbon is so slow that it has no appreciable poisonous effect in the surrounding air.

Hertha Ayrton, the distinguished wife of Professor Wm. E. Ayrton, of London, has given much time to the study and experimental investigation of the electric arc, and has found that the presence of oxidized products such as CO_2 between the carbons where opposed, is the cause of the phenomenon of hissing and instability noted when arcs in open air run too short. The hissing is accompanied by sudden fall of potential across the arc, indicating less energy required to be expended in passing the current. These effects were quite absent in arcs surrounded by dry hydrogen. The inclosed arc, owing to oxygen exclusion, is much less liable to these irregularities than the open air arc. Leaving, for the moment, the question of cost, there appears at present to be no possible substitute for carbon in lighting by the electric arc, and certainly the cheapness, workability and adjustability are factors which, added to its other qualities, make it specially adapted for that use as well as for electric furnace electrodes. Such furnaces as those in which the electric arc is the heating agent, as in the manufacture of carbide of calcium, depend upon the carbon arc alone.

The position which carbon occupies in incandescent electric lighting is no less unique. The filament or "burner," which *doesn't* burn, is invariably composed of carbon, and there is no present prospect of its displacement in favor of any other substance. It will be remembered that Edison worked for two years without success upon a lamp having as its incandescing conductor a wire of iridio platinum heated in the open air. Experiments had been made by others using thin carbon rods in open air, fed forward as fast as they were consumed. When Edison here and Swan in England made use of thin strips of carbonized material with the complete exclusion of oxygen obtained by the use of a vacuous inclosing bulb, success was immediate. Even this work had been foreshadowed by Starr away back in the forties. The vacuum bulb, far from being a disadvantage, not only afforded physical as well as chemical protection, but in addition greatly increased the economy of light production by abolishing loss of heat by gas convection. As with the arc the property of infusibility and high sublimation temperature, or low vapor tension even at high temperatures, makes carbon practically the only available material for incandescent lamps.

The life of such lamps would be very short if at the temperature of working or incandescence there was any sensible evaporation of the carbon. But after all the working temperature has been selected low enough to avoid rapid deterioration, it being well understood that the efficiency of the lamp would rise very rapidly with moderate increase of temperature. If forced too far the carbon does apparently gradually evaporate. It also softens and bends by its own weight. But it nevertheless retains considerable rigidty even up to the point of rapid sublimation by excessively high temperature. In one instance an assistant accidentally connected a 25-volt lamp across mains at 1,000 volts, but only for a fraction of a second. The lamp actually remained intact except that surrounding the filament, as an exquisitely delicate black mantle about $\frac{3}{8}$ of an inch or more in diameter, was a deposit of carbon. It had been suddenly evaporated from the carbon into the vacuum and condensed at a short distance away from the filament. The walls of the glass bulb were left perfectly clear and the filament was apparently uninjured. The darkening of the glass bulb of an incandescent lamp after prolonged use indicates the slow deterioration of the carbon filament by loss of its substance. Whether this loss is due to a true evaporation or to gas attrition, or whether the carbon is carried by electric discharges traversing the vacuous space around the filament is not definitely determined. The deposit may be due to a combination of all these causes. The formation of an incipient deposit of fine carbon is indeed helpful in the sense that it improves the vacuum by taking up the residual gas. During use the vacuum of the good incandescent lamp gradually perfects itself.

On letting in the air to a lamp bulb blackened by long use and heating the bulb the sooty coating readily burns off, and this at a temperature so low that there is no risk of softening the glass and deforming the thin bulb. The powder deposited in the glass seems to be oxidized with great facility.

Turning now to the manufacture of the lamp, it will be noticed that the properties of carbon and some of its compounds greatly favor the manipulation. Formerly filaments cut from paper or bamboo were used. After these came parchmentized thread bent over a carbon form and carbonized at high temperatures with exclusion of air. At present the practice of squirting a viscous cellulose solution through a small hole into a coagulating liquid is almost universal.

The gelatinous thread so formed is wound upon a drum and dried, thus becoming very considerably smaller and quite tough and horny. These cellulose threads are wound upon carbon forms in the shape desired and carbonized at a high temperature. This gives a structureless carbon thread or wire of uniform texture and size. Subsequent operations are directed to standardizing the resistance at the working temperature. The adjusting operation utilizes another property of carbon compounds. The process is called "flashing" and consists in highly heating the filament in a chamber filled with hydrocarbon vapor at such low pressures as a few centimeters of mercury, thus depositing a skin of hard dense carbon of good conductivity upon the *base*, as it is called. This "treating" or "flashing" process is conducted while measurements are made, and is stopped when the filament has reached the standard resistance. It is fortunate that such a simple method of adjustment existed. It has, however, the additional merit of tending to cause the current to flow mainly upon the outside skin of the filament where the energy should be delivered for the best results.

In a coarse filament, an equal rate of energy delivery throughout the section would be liable to overheat the interior and produce cracks and fissures, if not vapor pressure. The effect may be illustrated by the following experiment: Let a thin strip of carbon, such as a lamp filament, be immersed in liquid gasoline and an electric current be passed through it so as to bring it to a high temperature under the liquid, which goes into the spheroidal state and virtually surrounds

the hot carbon with a layer of vapor. In this case the filament gradually thickens by carbon deposition. As its diameter increases, more and more current will be required to keep up the temperature. In this way the filament may receive such a thick deposit that it may reach say 1 cm. in diameter. It might be supposed that a dense, hard rod of good conducting carbon had thus been obtained. Upon examination, however, it will be found that the interior of the thick rod is quite spongy and soft. The carbon of the interior, originally dense and hard, had later become overheated owing to the outer deposits preventing cooling. The result of the overheating is to reduce automatically the conductivity of the interior carbon by vaporizing it in part and rendering what remains soft and spongy, like soft porous graphite. The various parts of the section thus adjust the rate of energy delivery to them in accordance with their ability to dissipate heat.

It may here be noted that in the same way the inner core or hottest part of the charge in a carborundum furnace, as at Niagara, becomes converted into a pure graphite, loose and spongy in texture, all other substances and even part of the carbon having been driven out in vapor. Hence carbon may be purified by bringing it up to the temperature of sublimation.

The Protective Power of Paints.

In a paper read some time ago before the Newcastle section of the Society of Chemical Industry, Mr. Henry Smith, F.I.C., described a series of very interesting experiments upon the comparative protective powers of different paints as applied to ironwork. Three series of experiments were made. In the first series a method originating with Mr. Max Toltze was employed. A number of iron dishes, 5 inches across and about ½ inch deep were cleaned and carefully painted with two coats of the paint to be tested. These dishes were then filled with water, which was allowed to completely evaporate at the ordinary temperature of the laboratory, after which the dish was again filled up, this operation being repeated six times in the course of the six months over which the experiments extended. The paints used were prepared by grinding the pigments with linseed oil on granite rollers to a stiff paste, which was then thinned with best quality boiled linseed oil—itself capable of drying in seven hours to a hard film when painted on to a glass plate. Thus tested, the only paints which remained practically unaffected were red lead or orange lead paints, some of which, however, such as the "vermilionette" and the scarlet red paints, contained also a certain proportion of aniline colors; whilst two of the red-lead paints contained, in the one case 45 per cent. and in the other 66 per cent. of barytes. All the other dishes were more or less rusted, the order of merit of the better paints being as follows: 1. Zinc white. 2. Equal parts zinc white and barytes. 3. Zinc white, 3 parts; barytes 7 parts. 4. Lithopone (a mixture of zinc sulphide, zinc oxide, and barium sulphate). 5. Pure white lead. 6. White lead, 5 37 parts; barytes, 4.03 parts. 7. White lead, 5.05 parts; barytes, 4.21 parts. All the other paints, 36 in number, proved very inefficient, the first dish to show signs of rust being that painted simply with linseed oil. In the second series of experiments a number of painted iron plates were exposed to the weather for a twelvemonth, and with the single exception of the plate painted simply with linseed oil, all withstood the test remarkably well. In the third series of tests, strips of iron were painted, and when the second coat was quite dry these strips were placed in wide mouthed glass bottles, which were then nearly filled with water and allowed to stand. The bottles were not closed, but the contents were protected from dirt by standing them under a shelf, there being about ½ inch of space between the top of the bottles and the underside of this shelf. The bottles were left untouched for three months. Some of the plates were sensibly affected within seven days; but those which successfully withstood the shallow-dish test also resisted this one most successfully. The fact that paints containing such large proportions of barytes, as some of the lead paints noted above, gave such excellent results is of much interest, as it goes to show that this material can hardly be considered as a mere adulterant. In fact, one paint made up only of barytes and linseed oil gave better results than an oxide of iron paint. Mr. Smith refers with approval to the methods adopted in painting the Forth Bridge. All plates and bars for that structure were cleaned with steel scrapers and wire brushes and then coated with hot linseed oil. As soon as possible after erection they received two coats of red lead paint, which were subsequently followed by two coats of iron oxide. The life of the paint on the upper portions exposed to the weather is found to be about three years, but it must be added that the paint is then still in good condition, and on less important bridges would by many engineers be allowed to pass for several years longer. Experience shows, however, that in such cases the metal is liable to be deeply pitted. The paint inside the tubes of the Forth Bridge is as perfect as when first applied twelve years ago. The parts of the bridge most subject to rust are near the water, where the underside of the girders get sprayed with salt. The rusting commences on the rivet heads and the edges of the plates. These portions of the bridge are cleaned and repainted every year. The work is in charge of Mr. A. Hunter, who has supplied Mr. Smith with the above particulars.

Electrical Conductors and Dirt.

Mr. A. A. C. Swinton, writing in the *Electrician* (London) says:

Everyone must have noticed how electrical wires and fittings gather dust. Hot water pipes have a similar tendency, and for a long time I was of the opinion that the action was similar in both cases, and was due to air currents produced by heat. Recently, however, I have had reason to alter my views, and the matter appears to be of sufficient interest for detailed description.

In a new office I have now occupied for five months there are in my room five plain pendant fittings. As the ceiling is of concrete, and as it was necessary not to disturb the tenant above, these pendants all consist of plain flexible cords of the usual twisted pattern, which start from ceiling roses on the wall near the cornice, and are led through insulated eyes across the ceiling to the points from which they hang. The supply is the continuous current supply of the Westminster Company at 200 volts. Three of the pendants are upon one switch, the other two being upon another switch. Of the set of three, two are of 16 candle power, one of 32 candle power. I mention this latter fact, though it has nothing to do with the phenomenon observed. All the lights in practice are used at once, so that in this respect the conditions are the same in each case. The following, however, are the results, which are sufficiently remarkable to deserve notice.

Within a week or two of my entering into occupation of the office and using the lights it was observed that, whereas the three flexible cords connected with one switch remained clean, the two cords on the other switch were rapidly accumulating dust. The latter were repeatedly dusted, but the effect always repeated itself. At present, after some five months' use, while the one set of three cords is still comparatively clean, never having been dusted, the other set of two cords is thickly covered with an aggregate of dust particles, which in some places project fully one quarter of an inch from the cord. Further, while the plaster of the ceiling in the case of the set of three cords is absolutely white and the ceiling roses at the ends of these cords retain their original color, the ceiling immediately above the set of two cords is blackened with a well-defined broad, dark line, while the ceiling roses that serve these two cords are also covered all over with a dark deposit.

Now for the reason of this strange phenomenon. It is very simple. In the case of the set of three pendants the flexible cords and ceiling roses of which do not become dirty, the switch is in the positive pole. In the case of the other set of pendants, whose cords and roses become covered with dust, and which even blacken the ceiling with which they are not in contact, the switch is in the negative pole. Now, as is well known, the negative conductor in the street mains has a tendency to earth itself to an extent which is sufficient to cause the negative lead to be almost always at the same potential as earth. Consequently, the positive conductor is always at nearly 200 volts potential above that of earth, and therefore above that of the dust particles present in the atmosphere. This point has been tested in my office with a volt meter, with the results that from the negative there are only about 30 volts to earth, while from the positive there are 170 volts to earth. The reason for the effects observed is thus obvious. In the case of the three pendants, whose switch is in the positive, it is only when the switch is turned on a few hours per diem out of the 24 that there is any appreciable difference of potential between the cord and the surroundings. Even then it is only one conductor in the cord that has this potential, and the exterior of the covering very possibly always retains zero potential. In the case of the other set of two lamps, whose switch is in the negative, the result is far different. When the switch of this set is turned on, no doubt the conditions are similar to the other set when the latter's switch is also turned on. But during the many hours every day when the switch is turned off, in the case of the 2 light set both of the conductors remain constantly at a potential 170 volts above that of its vicinity. The dust is therefore caused to deposit upon the cord and

upon the ceiling rose by electrostatic attraction. No doubt the use of 200 volts, which will give four times the attraction afforded by 100 volts, has made the effect more marked in this particular case.

I should not have thought it worth while bringing the above facts forward publicly had they not been so marked as to be a serious nuisance in the case of the pendants whose switch is in the negative. From the point of view of the wiring of decorated rooms in a town with an atmosphere like London, the matter is of very considerable importance. It will be found that with the switches in the negative, an amount of dirt will be deposited in a few weeks that would take years to accumulate with the switch in the positive. I am well aware that from a totally different point of view, in damp situations, there is an advantage in putting the switch in the negative, for the reason that otherwise the metallic mechanism of the switch is liable to be corroded away by electrolytic action. In dry places, however, where it is desired to keep electrical wires and fittings clean, I have no doubt that in an atmosphere such as we have in this great city, switches should always be placed in the positive conductor, so that the exteriors of such fittings and wires should remain as far as possible at earth potential.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

THE equity in the plant of the Bath (Me.) Gas and Electric Company has been secured by a syndicate headed by Mr. George F. West, of Portland, Me.

A CORRESPONDENT, writing under date of the 12th inst., says: "At a meeting of the Directors of the Athens (Ohio) Gas Light and Electric Company, held the 11th inst., Mr. Charles H. Welch, heretofore Manager, of that Company, was elected its President and General Manager. Mr. Welch guided the Company's affairs through a series of successful years, during which period he has had to do with the competition of electricity and natural gas; but the current year finds its trading in a more prosperous condition than ever. It will be recalled that Mr. Welch, under the stress of natural gas competition in 1899, hurriedly and successfully made ready his lines and services for the distribution of natural gas, and within 30 days had abandoned the the manufacture of gas and was supplying all his customers with the natural article for light and fuel. In fact it may fairly be claimed that Mr. Welch stands alone in his application of such heroic and unique treatment of so serious a gas problem."

THE following is the text of the circular forwarded by Mr. Gardner Morse, Secretary of the New Haven (Conn.) Gas Light Company to the shareholders respecting the issue of new shares in the Company, mention of which proposed issue was made in the JOURNAL for last week:

"Pursuant to authority given to the Board of Directors at the annual meeting of the stockholders, held on January 2, 1900, the Directors hereby advise you that they deem it for the best interests of the Company that the capital stock be increased by the issuance, on July 2, 1900, of 10,000 new shares of stock of the par value of $25 each. Each stockholder of record at the close of business hours on June 1, 1900, will have the right to subscribe for this stock in the ratio of one new share for every four shares of old stock then held. These rights may be sold, using the annexed blank for assignment. In part payment of each share of new stock there will be credited to the subscriber $10 out of the accumulated surplus earnings of the Company, which in the opinion of the Directors should be capitalized. The balance of $15 per share is payable on or before July 2, 1900. Subscriptions from stockholders or purchasers of rights must be filed at the office of the Company on or before that day. A discount at the rate of 5 per cent. per annum will be allowed upon advance payments. No subscriptions will be received except from holders of four rights, or multiples thereof. Purchasers of rights should file their assignments with their subscriptions. New stock certificates will be issued on July 2, 1900, and such stock will participate in dividends thereafter declared. The transfer books of the Company will be closed from June 2, 1900, to July 2, 1900, both days inclusive."

IT is more than likely that the Company will go in extensively for the reconstruction of its plant, although it is possible that the completeness of the scheme of rebuilding will be on a scale sufficient to delay its actual beginning until 1901.

THE Directors of the Consolidated Gas Company, of Baltimore, Md., have declared a semi-annual dividend of 2 per cent., payable the 1st prox. We understand that no action was taken over the measure passed some weeks ago by the Legislature requiring the Company to put its selling rate at $1.10 per 1,000. That inactivity may fairly be taken to mean that the Company will accept the decree. It goes into effect the 1st prox.

THE proprietors of the Hanover (Pa.) Gas Company have increased their net selling rate to $1.80 per 1,000, from $1.50.

THE offices of the Laclede Firebrick Manufacturing Company are still in 914, 915 and 916, Wainwright Building, St. Louis, Mo.

AT the annual meeting of the Marshall (Mo.) Gas Light Company the officers chosen were: Directors, J. P. Huston, Thomas Boatright, C. A. Manch, Joseph Wronker and D. D. Duggins; President, J. P. Huston; Vice-President, D. D. Duggins; Secretary, Treasurer and Superintendent, Thos. Boatright.

MRS. HELEN ARMSTRONG recently finished a very successful week's lecturing on the advantages of cooking by gas, under the auspices of the Van Wert (O.) Gas Light Company. The Van Wert Company is selling gas for fuel purposes at the rate of 80 cents per 1,000, and Gen. Manager Summers is quite elated over the number of orders in hand for gas ranges and lesser gas cooking appliances. Mr. Summers further adds, respecting Mrs. Armstrong's qualifications as a lecturess: "You need have no hesitation in recommending Mrs. Armstrong to inquiring gas men. I feel that this word of commendation is due her because of her satisfactory work here."

A CORRESPONDENT in Keokuk, Ia., writing under date of the 14th inst., says: "The Keokuk Gas Light and Coke Company passed into the hands of new management, May 16th. Mr. I. C. Elston, Secretary of the Ottumwa (Ia.) Gas Company, will be the President and Treasurer, and Mr. H. B. Maynard, the present Manager of the Ottumwa Company, will be the Secretary. Mr. H. R Miller, who has been the President of the Keokuk Company for 25 years, will retire. He is one of the most genial, popular and able men in Keokuk. He will take a well earned vacation, following which he proposes to take up active work in a new field."

WE understand that Mr. Henry Payne has been appointed official gas inspector for Cleveland, O., vice Mr. William King, resigned.

SOME time ago we noted the resignation, from the Board of Directors of the Cincinnati Gas Light and Coke Company, of Mr. Robert Allison. On accepting the resignation the Board caused the following minutes to be spread on its records:

"The Directors of the Cincinnati Gas Light and Coke Company, in parting with Mr. Robert Allison, wish to place upon record an expression of their high estimation of him as a citizen, a fellow director and a personal friend.

"For nearly 50 years he has been a resident of this city, during which period he has taken an active and intelligent interest in public affairs, having served in the City Council for four years, in the Board of Education six years, as a Commissioner, having in charge the building of the City Workhouse, six years, and on a similar commission engaged for five years in superintending the erection of the present City Hall, which latter fine building was completed with a very considerable balance unexpended of the amount appropriated for its erection.

"It is not surprising that after 21 years of such unselfish efficient service he was again called upon by his appreciative fellow-citizens to occupy another station of honor and responsibility as a member of the Board of Public Service, to which position he was elected by an exceptionally large vote, and to the Presidency of which he was deservedly elevated by common consent.

"He became a Director in this Company in 1878, and has served in that capacity during 22 consecutive years, for the last ten years being also a member of the Company's Executive and Finance Committees. To the duties of these positions he gave the same faithful, painstaking attention which characterized his business career, and has by all means within his power contributed to the Company's prosperity.

"We accepted his resignation only upon his urgent request, and with grateful appreciation of his protracted and valuable services, and are glad to unite in this expression of our sincere and well-deserved esteem."

AT the annual meeting of the Wyandotte Gas Company, of Bethlehem, Pa., the officers elected were: Directors, E. H. Jones, John Flanigan, Liddon Flick, R. J. Flick, W. P. Billings and E. C. Jones;

President, E. H. Jones; Vice-President and General Manager, John Flanigan; Secretary and Treasurer, E. W. Mulligan.

JUDGE HOSMER, of Detroit, Mich., has granted a perpetual injunction against the Gas Consumers' Association restraining it from interfering with the Detroit Gas Company's pipes or connections. He orders that the Association shall give the Gas Company 24 hours' notice when it wants to attach a regulator to a riser from a meter, that the Company may have its inspectors on hand, and that the inspectors' bill of expenses shall be paid by the Association.

THE Fulton County Gas and Electric Company, to manufacture and supply gas and electricity for lighting the streets and public and private buildings, of Gloversville and Johnstown, Fulton county, N. Y., has been incorporated. The concern is capitalized in $1,500,000, and the named Directors are: George E. Spencer, John B. Summerfield, Armitage Matthews, H. C. Everdell and James C. Young. The correspondent who sends this item says the Company is likely formed for the purpose of taking over and consolidating the existing gas and electric lighting interests of Johnstown and Gloversville.

MR. FRANK GEISE, Mayor of York, Pa., and at one time President of the Charleston (S. C.) Gas Light Company, died at his home in York the night of the 1st inst. He was in his 63d year.

AT the annual meeting of the shareholders in the South Side Gas Company, of Pittsburg, Pa., the following Directors were chosen: W. H. Alldred, Robert B. Brown, Samual T. Bodine, James Ball, Walton Clark, Lewis Lillie, Randal Morgan, F. H. MacMorris and George S. Philler.

A CONTRACT for the public lighting of Stoughton, Mass., by means of 1,200 candle power arc lamps, has been awarded to the Stoughton Gas and Electric Company. Under the agreement the Company will maintain 60 lamps, at $50 per lamp per annum, the lamps to be alight from dusk to 1 A.M.

MISS LUCY C. ANDREWS, of Philadelphia, Pa., recently concluded a series of demonstration lectures on cooking by gas in Dallas Texas. A week was devoted to the exposition, and it was planned and carried out under the direction of Mr. Thomas D. Miller, Manager of the Dallas Gas and Fuel Company. The attendance at the lectures was remarkable for numbers and the interest shown.

AT the annual meeting of the Winona (Minn.) Gas Light Company the officers elected were: Directors, M. S. Norton, W. H. Laird, Wm. Mitchell, R. T. Lamberton, H. C. Stevens, C. A. Boalt and H. W. Lamberton; President and Treasurer, H. W. Lamberton; Vice-President, H. C. Stevens; Sec. and Manager, C. A. Boalt. The Company has secured handsome and commodious offices at No. 115 Center street, and now maintains a well-arranged show room for the display of cooking and heating apparatus, improved burners, up-to-date gas fixtures, etc.

THE following is the text of the opinion rendered by Attorney General Davies, in the matter of the petition of the Central Federation of Labor to compel the Municipal Gas Company, of Albany, N. Y., to desist from causing its employees to work more than 8 hours per day—the decision explains the points involved:

STATE OF NEW YORK, ATTORNEY-GENERAL'S OFFICE,
ALBANY, May 1, 1900.

To the Trustees of Public Buildings, Albany, N. Y.: Gentlemen—I have received a communication from Mr. H. H. Bender, Superintendent of Public Buildings, under date of April 24th instant, inclosing copies of contract with the Municipal Gas Company, dated June 1st, 1899, for the lighting of the Capitol and other public buildings, a petition from John C. Seemann and others, representing the Central Federation of Labor of the city of Albany, asking for the cancellation of said contract, and a brief from Mr. Andrew Hamilton, Counsel for the Municipal Gas Company.

I am asked for my opinion as to whether or not the provisions of Section 3 of the labor law, as amended by Chapter 567 of the laws of 1899, are applicable to this contract.

The contract in question was prepared under my supervision, and the question now presented arose and was carefully considered at that time by this department. It was then understood that the position of the Municipal Gas Company was that the labor law was not applicable to a contract of this character, and that it would refuse to execute a contract containing the provisions required by Section 3. After careful consideration I reached the conclusion that the provisions of said section were applicable to this contract which did not comply with them. I have seen no reason for changing the opinion which I then expressed.

The contract requires the Municipal Gas Company to furnish for the use of the State a sufficient quantity of current to supply and operate the electric lights in the Capitol and Executive Mansion and to operate an elevator; and also a sufficient quantity of gas for the lighting of said buildings and for the use of certain heating logs.

Section 3 of the labor law contains the following provision:

"Each contract to which the State or a municipal corporation is a party, which may involve the employment of laborers, workmen or mechanics, shall contain a stipulation that no laborer, workman or mechanic in the employ of the contractor, sub-contractor or other person doing or contracting to do the whole or a part of the work contemplated by the contract shall be permitted or required to work more than 8 hours in any one calendar day, except in cases of extraordinary emergency, caused by fire, flood or danger to life or property."

The question presented, then, is whether the contract in question "may involve the employment of laborers, workmen or mechanics." It seems to me to be apparent that it not only may involve such employment, but that it necessarily does involve such employment. It is simply a physical impossibility to produce the electric current called for by the contract without such employment. It seems to me that this contract is easily distinguishable from a contract for the purchase of ordinary commodities by the State. If the State desires to purchase carpets, furniture, etc., it may doubtless do so without reference to the number of hours per diem which the workmen were employed in making the same. But if the State entered into a contract for the manufacture and delivery of such articles for the use of the State, then the provisions of the labor law would doubtless be applicable. The fact that this particular Company is also engaged in supplying individuals with lights, is not in my judgment important or controlling. If it deals with the State, it voluntarily brings itself within the provisions of the law and subjects itself to its requirements. At the time when the contract was prepared, there was inserted in it, at the request or suggestion of the Company, the following provision:

"None of the provisions of this contract limiting the hours of labor or regulating the rate of wages, shall apply to or affect any other contract, or any labor, services or material performed for or supplied to any person or party excepting the State of New York."

I thought at the time, and still think, that this provision is superfluous and meaningless. It is needless to say that no official of the State, in the absence of express authority of law, has any power to regulate or interfere with contracts between this Company and individuals. The trustees of the public buildings are not called upon and have no authority to enforce the provisions of the labor law, except as to labor and services performed for them or under their supervision. If this provision is to be regarded as in any sense a construction or interpretation of the provisions of the labor law, then, in so far as it conflicts, if at all, with the true meaning and intent of that law, it is a nullity. I am, therefore, of the opinion that the provisions of the labor law to which I have referred are applicable to this contract.

Novel Use for a Pile Driver.

Engineering News notes that a pile driver breaking asphalt pavement is an interesting sight on one of the streets in Brooklyn, N. Y., at the present time. The pavement in question is an accretion. Down at the bottom is an old cobblestone pavement of the type for which this borough is widely famed. The ingredient stone are of the class condemned for ordinary riprap, being of all shapes and qualities and ranging in size from about the volume of an apple to a pumpkin. Finally the cobblestone of this particular street failed to find favor in the eyes of the people and they commenced to cover it with coal tar and asphalt.

Just how many washes of these materials were applied it is impossible to state at this writing, but the best that was ever said for the result by the city authorities was that it was not bad. Compared with cobblestone this was true, but compared with a good pavement it was judiciously indefinite.

The reason for the failure of all attempts to secure a permanently smooth surface is stated to be the great depth of the bituminous material. However, the surface is now being broken up by a pile driver, and a good pavement is to be laid.

The pile driver frame is about 15 feet high and mounted on a heavy cart, which also also carries a little hoisting engine used to lift the

(*Concluded on page* 818.)

THE AMERICAN GAS LIGHT JOURNAL

A. M. CALLENDER & CO.,
PROPRIETORS.

THOS. J. CUNNINGHAM,
ELBERT P. CALLENDER,
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CHAS. E. SANDERSON,
MANAGER.

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AGENTS:

New York—American News Co. 39 and 41 Chambers St.
Germany—Lemcke & Buechner, of New York.
England—Aug. Siegle, 30 Lime Street, London.

MONDAY, MAY 21, 1900.

(*Continued from page* 817.)

hammer. The latter weighs about 1,700 pounds, and has a chisel edge at the bottom about 14 inches long. At every few blows of the hammer, the cart is dragged along a foot or so, and after the cart has covered a sufficient length of pavement a gang is put on the work to complete by hand the breaking up of the surface.

The removal of the old pavement has proved a serious matter to the contractors, who first tried to tear it up with a strong plow drawn by a heavy road roller. This method was not successful, which is not surprising in view of the conditions brought to light by the excavations.

Mr. Nelson P. Lewis, engineer of highways of the borough, states that the first bituminous pavement laid in this country was the tar concrete put on the cobblestones of this street in 1868. The surface was repaired with gas and chemical tar, resurfaced with a mixture of one part of Trinidad asphalt to three parts of tar, and again resurfaced about 12 years ago with Trinidad Lake asphalt. The resulting thickness, 6 to 14 inches, is made up of hard and soft layers which allowed ridges to form and the depressions which always follow.

The cost of repairs became so great that it was more economical to put down a new concrete foundation and asphalt pavement than keep on maintaining the old work.

The Market for Gas Securities.

The past week in city gas share trading was notable in more respects than one. Early in the dealing all securities of this class were neglected, no one having a good word to say in favor of their purchase; but at the time of writing (Friday afternoon), a marked change in the thoughts of gas traders is more than apparent. The feature of the market was a pronounced stiffening last Tuesday in Consolidated, and the advance therein has been maintained steadily. Closing at 181 to 183 last Friday, the opening to-day was made at 191, and at 2 P.M., the rating on the Exchange was 196. The dealings were on a scale of considerable magnitude, and much of the buying was beyond doubt for people who know pretty well what is going on inside. Peace hath its victories, no less renowned than those of war, so it was said; and the truth of that old saw seems likely to be shown again in the case of the current gas-electric light war in New York, which certainly has been prolonged and bitter.

The suggestion to-day is that the New Amsterdam folks have had enough of the contest, and it is to be hoped for their sake that such is the case. If they want more of it, they can have it; but meanwhile interest goes on. A week will tell the story whether the contest is to be indefinitely prolonged. That peace is to prevail soon is strengthened by the quotations for other city gas shares, even New Amsterdams, common and preferred, having fairly held their own.

Brooklyn Union soared upward to-day, touching 159, and that mark is fully 40 points below its intrinsic value, if business and surplus are to count in estimating the worth of anything. Baltimore Consolidated is 52 bid, ex dividend of 2 per cent.; Peoples, of Chicago, is steady; Bay State is in some demand; and Washington, D. C., is 268¾ bid. The American Gas Company, of Philadelphia, Pa., has declared a semi-annual dividend of 3 per cent., payable the 1st prox.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

16 WALL STREET, NEW YORK CITY.

MAY 21.

☞ All communications will receive particular attention.
☞ The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$54,595,200	100	195¼	196
Central Union, Bonds, 5's.	3,000,000	1,000	103½	105
Equitable Bonds, 6's	1,000,000	1,000	105	..
" 1st Con. 5's	2,300,000	1,000	115	118
Metropolitan Bonds	658,000	.	108	112
Mutual	3,500,000	100	275	300
" Bonds	1,500,000	1,000	100	102
Municipal Bonds	750,000	.	..	
New Amsterdam Gas Co.	13,000,000	100	28½	28¾
Preferred	10,000,000	100	50	52
Bonds, 5's	11,000,000	1,000	99	100
Northern Union, Bonds, 5's.	1,250,000	1,000	95	97
New York and East River..				
Bonds 1st 5's	3,500,000	1,000	109	111
" 1st Con. 5's	1,500,000		115	..
Richmond Co., S. I.	348,650	50	70	..
" Bonds	100,000	1,000	..	..
Standard	5,000,000	100	105	116
Preferred	5,000,000	100	130	140
Bonds, 1st Mortgage, 5's	1,500,000	1,000	110	114
Yonkers	299,65	500	130	.
Out-of-Town Companies.				
Brooklyn Union	15,000,000	100	159¾	160
" " Bonds (5's)	15 000,000	1,000	118	119
Bay State	50,000,000	50	1⅛	1⅝
" Income Bonds	2,000,000	1,000	..	75
Binghamton Gas Works..	450,000	100	..	35
" 1st Mtg. 5's	475,000	1,000	96½	99½
Boston United Gas Co.—				
1st Series S. F. Trust	7,000,000	1,000	82	85
2d " " "	3,000,000	1,000	47½	50
Buffalo City Gas Co.	5,500,000	100	4¾	5
" " Bonds, 5's	5,250,000	1,000	69	71
Central, San Francisco	2,000,000	..	106	108
Chicago Gas Co. Guaranteed Gold Bonds	7,650,000	1,000	104	104¼
Columbus (O.) Gas Co., 1st Mortgage Bonds	1,207,000	1,000	106	107
Columbus (O.) Gas Lt. & Heating Co	1,682,750	100	60	65
Preferred	3,026,500	100	84	86
Consumers, Jersey City Bonds	600,090	1,000	102	105
Cincinnati G. & C. Co.	8,500,000	100	201½	202
Consumers, Toronto	1,700,000	50	230	235
Capital, Sacramento	500,000	50	..	35
Bonds (6's)	150,000	1,000		..
Consolidated, Baltimore	11,000,000	100	52	..
Mortgage, 6's	3,600,000	..	..	118
Chesapeake, 1st 6's	1,000,000	..	..	..
Equitable, 1st 6's	910,000	..	..	.
Consolidated, 1st 5's	1,490 000	..	..	112
Consolidated Gas Co. of N.J.	1,000,000	100	15	19
" Con. Mtg. 5's	380,000	1,000	82	86
Consolidated G. & E. Co.'s, Little Falls, N.Y.	90,000	100	..	100
Bonds	75,000	..	..	100
Detroit City Gas Co.	4,560,000	50	95¾	96
" Prior Lien 5's	4,598,000	1,000	99½	100
Detroit Gas Co., 5's	386,000	1,000	100	101
" Inc. 5's	16,000	100	100½	101
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Fort Wayne	2,000,000	..	35	41
" Bonds	2,000,000	..	60	64
Grand Rapids Gas Lt. Co.	1,000,000	50	..	..
" 1st Mtg. 5's	1,125,000	1,000	..	..
Hartford	750,000	25	..	220
Hudson County Gas Co., of New Jersey	10,500,000	..	25	..
" Bonds, 5's	10,500,000	..	102	105
Indianapolis	2,000,000	..	101	103
" Bonds, 6's	2 650,000	..	100	104
Jackson Gas Co.	250,000	50	72	78
" 1st Mtg. 5's	250,000	1,000	101	102½
Kansas City Gas Light Co., of Missouri	5,000,000	100	35	40
Bonds, 1st 5's	3,822,000	1,000	101½	103
Lafayette Gas Co., Ind.	1,000,000	100	40	45
Bonds	1,000,000	1,000	60	65
Louisville	2,570,000	50	106	
Laclede, St. Louis	7,500,000	100	66	68
Preferred	2,500,000	100	95	100
Bonds	10,000,000	1,000	110	110½
Madison Gas & Elec. Co.	400,000	100	82	..
" 1st Mtg. 6's	350,000	1,000	102½	108
Montreal, Canada	2,000,000	100	200	..
Newark, N. J., Con. Gas Co	6,000,000	..	..	55
Bonds, 6's	4,600,000	..	..	103
Essex and Hudson Gas Co.	6,500,000	..	35	40
New Haven	1,000,000	25	280	300
Nashville Gas Lt. Co.	1,000,000	50	110	..
Oakland, Cal.	2,000,000	..	46	47
" Bonds	750,000	..	..	..
Peoples G. L. & Coke Co., of Chicago	25,000,000	100	100¾	101
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	20,100,000	1,000	111⅜	111½x
2d "	2,500,000	1,000	104	105
Rochester Gas & Elec. Co.	2,150,000	50	88	..
Preferred	2,150,000	50	118	..
Consolidated 5's	2,000,000	..	87½	90
San Francisco, Cal.	10,000,000	100	46¾	47
St. Paul Gas Light Co.	1,500,000	100	57½	58½
1st Mortgage 6's	650,000	1,000	82	85
Extension, 6's	600,000	1,000	..	..
General Mortgage, 5's	2,428,000	1,000	88	90½
St. Joseph Gas Co.	1,000,000	100	42	44
" 1st Mtg. 5's	750,000	1,000	96½	98
Syracuse, N. Y.	1,750,000	100	..	15
Bonds	1,612 000	1,000	85	90
Washington, D. C	2,600,000	20	268¾	269⅛
First mortgage 6's	600,000	..	..	..
Western, Milwaukee	4,000,000	100	..	92
Bonds, 5's	3,830,500	.	104	106
Wilmington, Del.	600,000		2 0	50

Advertisers' Index.

GAS ENGINEERS.

	Page
Wm. Henry White, New York City	839
Fred. Bredel, Milwaukee, Wis.	826
Geo. R. Rowland, New York City	837
The Western Gas Construction Co., Fort Wayne, Ind.	844
Humphreys & Glasgow, New York City	837
American Gas Co., Phila., Pa.	826
David Leavitt Hough, New York City	836
Economical Gas Apparatus Construct'n Co., Toronto, Ont.	823
Baxter & Young, Detroit, Mich.	836
United Gas Improvement Co., Phila., Pa	831
James T. Lynn, Detroit, Mich.	836
A. E. Boardman, Brevard, N. C.	836

GAS WORKS APPARATUS AND CONSTRUCTION.

James R. Floyd's Sons, New York City..... 840
Continental Iron Works, Brooklyn, N. Y..... 838
Deily & Fowler, Phila., Pa..... 840
Kerr Murray Mfg. Co., Fort Wayne, Ind 836
Stacey Mfg. Co., Cincinnati, Ohio..... 839
Bartlett, Hayward & Co., Baltimore, Md..... 837
Davis and Farnum Mfg. Co., Waltham, Mass..... 836
R. D. Wood & Co., Phila., Pa..... 838
Isbell-Porter Company, New York City..... 838
Fred. Bredel, Milwaukee, Wis..... 826
United Gas Improvement Co., Phila., Pa..... 831
National Gas and Water Co., Chicago, Ills 833
Economical Gas Apparatus Construct'n Co., Toronto, Ont. 823
The Western Gas Construction Co., Fort Wayne, Ind.... 844
Humphreys & Glasgow, New York City..... 837
American Gas Co., Phila., Pa. 826
Logan Iron Works, Brooklyn, N. Y..... 840
Riter-Conley Mfg. Co., Pittsburgh, Pa..... 839
Baxter & Young, Detroit, Mich..... 836
Berlin Iron Bridge Co., East Berlin, Conn..... 825
G Shepard Page's Sons, New York City..... 836
James T. Lynn, Detroit, Mich..... 836
A. E. Boardman, Brevard, N. C..... 836
Sutherland Construction & Improvement Co., N.Y. City 824
Chris. Cunningham & Son, Brooklyn, N.Y..... 822

PROCESSES.

Bartlett, Hayward & Co., Baltimore, Md..... 837
United Gas Improvement Co., Phila., Pa..... 831
Burdett Loomis, Hartford, Conn..... 838
National Gas and Water Co., Chicago, Ills..... 833
Economical Gas Apparatus Construct'n Co., Toronto, Ont. 823
The Western Gas Construction Co., Fort Wayne, Ind.... 844
Humphreys & Glasgow, New York City..... 837
Sutherland Construction & Improvement Co., N.Y. City 824
B. E. Chollar, St. Louis, Mo..... 824

SCRUBBERS AND CONDENSERS.

R. D. Wood & Co., Phila., Pa..... 838
James R. Floyd's Sons, New York City..... 840
Continental Iron Works, Brooklyn, N. Y..... 838
Logan Iron Works, Brooklyn, N. Y..... 840
Riter-Conley Mfg. Co., Pittsburgh, Pa..... 839

TAR AND CARBONIC ACID EXTRACTOR.

R. D. Wood & Co., Phila., Pa..... 838

AMMONIA CONCENTRATORS.

Michigan Ammonia Works, Detroit, Mich..... 820
American Gas Company, Phila., Pa..... 826

GAS METERS.

John J. Griffin & Co., Phila., Pa..... 804
American Meter Co., New York and Philadelphia..... 843
Helme & McIlhenny, Phila., Pa..... 843
D. McDonald & Co., Albany, N.Y..... 841
Nathaniel Tufts Meter Co., Boston, Mass..... 842
Maryland Meter and Mfg. Co., Baltimore, Md..... 842
Metric Metal Co., Erie, Pa 843
Keystone Meter Co., Royersford, Pa..... 842
Detroit Meter Company, Detroit, Mich..... 843

PREPAYMENT METERS.

American Meter Co., New York and Philadelphia..... 843
John J. Griffin & Co., Phila., Pa..... 804
D. McDonald & Co., Albany, N. Y..... 841
Helme & McIlhenny, Phila., Pa..... 843
Nathaniel Tufts Meter Co., Boston, Mass..... 842

GAS AND WATER PIPES.

M. J. Drummond & Co., New York City..... 841
R. D. Wood & Co., Phila., Pa..... 838
Warren Foundry and Machine Co., New York City..... 841
Donaldson Iron Co., Emaus, Pa..... 841
Chris. Cunningham & Son, Brooklyn, N.Y..... 822
Cornell & Underhill, New York City..... 820
Charles Millar & Son Co., Utica, N. Y..... 841

GAS MAIN STOPPERS.

Safety Gas Main Stopper Co., N. Y. City..... 823

GAS TAPPING MACHINES.

George Light, Dayton, O..... 820

STEAM BLOWER FOR BURNING BREEZE.

H. E. Parson, Brooklyn, N. Y..... 833

GAS COALS.

Penn Gas Coal 835
Perkins & Co., New York City 834
Despard Gas Coal Co., Baltimore, Md..... 835
Westmoreland Coal Co., Phila., Pa..... 835
Berwind-White Coal Mining Co., New York and Phila... 824

CANNEL COALS.

Perkins & Co., New York City 834

CONVEYORS.

The Link-Belt Machinery Co., Chicago, Ills..... 823

GAS ENRICHERS.

Standard Oil Co., New York City 835
The Sun Oil Co., Pittsburgh, Pa..... 835

COKE CRUSHER.

C. M. Keller, Columbus, Ind..... 835

GAS GAUGES.

The Bristol Co., Waterbury, Conn..... 822

GAS GOVERNORS.

Connelly Iron Sponge and Governor Co., New York City 833
Isbell-Porter Co., New York City..... 838
R. D. Wood & Co., Phila., Pa..... 838
Wm M. Crane Co., New York City..... 821

CEMENTS.

C. L. Gerould, Galesburg, Ills 832

RETORTS AND FIREBRICKS.

J. H. Gautier & Co., Jersey City, N. J..... 832
Adam Weber, New York City..... 832
Laclede Firebrick Mfg. Co., St. Louis, Mo..... 832
Cyrus Borgner, Phila., Pa..... 832
James Gardner, Jr., Co., Pittsburgh, Pa 832
Henry Maurer & Son, New York City..... 832
Baltimore Retort and Firebrick Co., Baltimore, Md..... 832
Parker-Russell Mining and Mfg. Co., St. Louis, Mo..... 832
Brooklyn Firebrick Works, Brooklyn, N. Y..... 832
Missouri Firebrick Co., St. Louis, Mo 832

REGENERATIVE FURNACES.

Bartlett, Hayward & Co., Baltimore, Md..... 837
Fred. Bredel, Milwaukee, Wis..... 826
J. H. Gautier & Co., Jersey City, N. J..... 832
Parker-Russell Mining and Mfg. Co., St. Louis, Mo..... 832
Adam Weber, New York City 832

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Isbell-Porter Co., New York City..... 838
Continental Iron Works, Brooklyn, N.Y..... 838
Logan Iron Works, Brooklyn, N. Y..... 840
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INCANDESCENT GAS LAMPS.

Welsbach Commercial Co., Phila., Pa..... 830

BURNERS.

C. A. Gefrorer, Phila., Pa..... 838
Wm. M. Crane Co., New York City 823
D. M. Steward Mfg. Co., Chattanooga, Tenn..... 823

LAVA GAS TIPS.

D. M. Steward Mfg. Co., Chattanooga, Tenn..... 823

STREET LAMPS.

Welsbach Street Lighting Co., New York and Phila. ... 828
Thos. T. W. Miner, New York City..... 820

PURIFIERS.

Stacey Mfg. Co., Cincinnati, O..... 824

PURIFYING MATERIALS.

Connelly Iron Sponge and Governor Co., New York City 833

VALVES.

Ludlow Valve Manufacturing Co., Troy, N.Y..... 822
Chapman Valve Manufacturing Co., Boston, Mass..... 822
R. D. Wood & Co., Phila., Pa..... 838
Continental Iron Works, Brooklyn, N. Y..... 838
The P. H. & F. M. Roots Co., Connersville, Ind..... 827
Isbell-Porter Co., New York City 838
The Western Gas Construction Co., Fort Wayne Ind.... 844

EXHAUSTERS.

The P. H. & F. M. Roots Co., Connersville, Ind 827
Isbell-Porter Company, New York City..... 833
Connelly Iron Sponge and Governor Co., New York City 833

ELECTRICAL APPARATUS.

Wm. Henry White, New York City..... 839

ENGINES AND BOILERS.

The Hazelton Boiler Company, New York City..... 820

PURIFIER SCREENS.

John Cabot, New York City..... 822

GAS STOVES.

American Meter Co., New York and Philadelphia..... 829
Maryland Meter and Manufacturing Co., Baltimore, Md. 842
Keystone Meter Co., Royersford, Pa..... 842
Wm. M. Crane Co., New York City..... 821
Nathaniel Tufts Meter Co., Boston Mass..... 842
Detroit Stove Works, Detroit, Mich 781
Pangler Stove and Mfg. Co., Cleveland, O..... 820

HOT WATER HEATERS.

Wm. M. Crane Co., New York City..... 821

GASHOLDER TANKS.

P. Whittier, Brooklyn, N. Y..... 837

GASHOLDERS.

Bartlett, Hayward & Co., Baltimore, Md..... 837
Continental Iron Works, Brooklyn, N. Y..... 838
Deily & Fowler, Philadelphia, Pa..... 840
Davis & Farnum Mfg. Co., Waltham, Mass..... 836
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 836
Stacey Mfg. Co., Cincinnati, Ohio..... 839
R. D. Wood & Co., Philadelphia, Pa..... 838
Logan Iron Works, Brooklyn, N. Y..... 840
Riter-Conley Mfg. Co., Pittsburgh, Pa..... 839

STORAGE TANKS.

Chris. Cunningham & Son, Brooklyn, N.Y..... 822

GAS SECURITIES.

Henry Marquand & Co., New York City..... 820

ADVERTISING.

J. Howland Harding, New York City..... 820

BOOKS, ETC.

Newbigging's Handbook..... 828
Field's Analysis, 1898..... 825
Scientific Books..... 834
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Gas Flow Computers..... 842
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Excerpts from Reports of Gas Commissioners..... 803
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DIVIDEND NOTICE.

OFFICE OF THE AMERICAN GAS COMPANY,
222 S. THIRD ST., Phila., Pa., May 16, 1900.

The Board of Directors of The American Gas Company have this day declared a semi-annual dividend of 3 per cent., or $3 per share, on the Capital Stock of the Company, payable on and after June 1, 1900.

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As Superintendent of Gas Works,

By a young man who is a hustler for new business; has experience in selling gas stoves; understands the manufacture of coal and water gas in detail (Lowe or Springer's); also experienced in working ammoniacal liquor; is assistant to superintendent of works with an output of 1,000,000 cubic feet per day.

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By a Man who is not Afraid of Hard Work.

Has had 20 years' experience in all the departments—manufacturing, distribution, new business and office work.

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Thoroughly Competent Gas Manager of many years' experience in the manufacturing and the executive ends of a Gas Company desires a position as Manager or Engineer of a Gas Company selling not less than 50,000,000 cubic feet per annum. Highest references given. Address "T.,"
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Official Position in Gas Company,

By experienced man. Experienced in office management and successful in pushing sales of gas appliances.

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Must be sober and industrious. State salary wanted and references. BOWLING GREEN GAS LIGHT CO.,
1301-tf Bowling Green, Ky.

WANTED,

Three or Four Second-Hand Purifiers,

Not less than 10 by 10 or 10 by 12 feet, with seals 18 to 24 inches. Also One Second-Hand Water Gas Apparatus of about 125,000 capacity. Must be in good condition.

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TO LEASE A GAS PLANT,

In a place of 8,000 to 12,000 population. No objection to a run down plant if terms are right. No objection to a gas and electric light plant combined. Can give best of references. Address "W. K.,"
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1	Mackenzie Exhauster		24	in. diam.,	26	in. long,	belt	driven.
2	"	"	48	" "	30	" "	"	"
1	"	"	48	" "	48	" "	"	"
1	Wilbraham	"	40	" "	42	" "	"	"
1	"	"	48	" "	48	" "	"	"

Direct connnected to 10 x 20 Wilbraham Slide Valve Engine.
3 Wilbraham Blowers, 48 in. diam., 72 in. long, belt driven.

Also 1 Discharging Machine, complete, with boiler.

Two Discharging Machines, without boilers (made by United States Stoking Machine Company).

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Rights for a Patented Improved Gas Meter.

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MALLEABLE AND CAST IRON FITTINGS,

Brass and Iron Cocks and Gate Valves,

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A Small Gas and Electric Light Plant,

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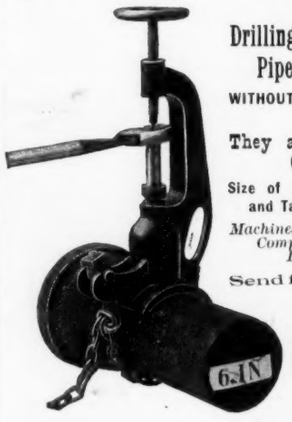
WITHOUT ANY ESCAPE OF GAS.

They are Strong and Compact.

Size of Combination Drills and Taps ¾ to 4-inch.

Machines Sent to any Gas Company for Thirty Days' Trial.

Send for Circulars.



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Economy, Safety, Capacity, Durability.

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Send for New Catalog.

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THE NEW "VULCAN" GAS RANGE.

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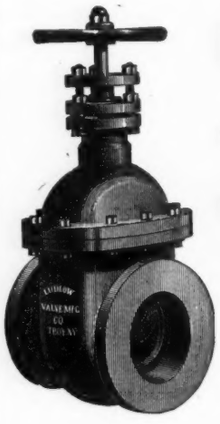

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Gas, Water, Steam, Oil, Ammonia, Etc.

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Telegraphic Address: "CARBURETED LONDON AND TORONTO."

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Blackburn, Eng.	1,250,000	Wilkesbarre, Pa.	750,000
Windsor Street Works, Birmingham, Eng.	2,000,000	St. Catherine's (Second Contract),	250,000
Saltley Works, Birmingham, Eng.	2,000,000	Buffalo, N. Y.	2,000,000
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Birkenhead, Eng.	2,250,000	Colchester, Eng. (Second Contract),	300,000
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Saltley Works, Birmingham, Eng. (2d Contract)	2,000,000	Rochester, Eng.	500,000
Windsor St. W'ks, Birming'm, Eng. (2d Contract)	2,000,000	Kingston, Ont.	300,000
Halifax, Eng.	1,000,000	Crystal Palace District, Eng.	2,000,000
Toronto,	250,000	Duluth, Minn.	300,000
Ottawa,	250,000	Caterham, Eng.	150,000
Toronto (Second Contract, Remodeled),	2,000,000	Enschede, Holland,	150,000
Lindsay (Remodeled),	125,000	Leicester, Eng.	2,000,000
Belleville,	250,000	Buenos Ayres (River Platte Co.),	700,000
Ottawa (Second Contract),	250,000	Burnley, Eng.	1,500,000
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St. Catherine's (Remodeled),	250,000	Accrington, Eng.	500,000
Kingston, Pa.	125,000	Tonbridge, Eng.	300,000
Montreal,	500,000	Stretford, Eng.	500,000
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It's Lava.
The Flame Seats on it.

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STEWARD BURNERS

ARE MORE DURABLE.

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AN EVEN PRESSURE AT ALL TIMES!

Is Insured by Using the

"Vulcan" Gas Controller

For All Kinds of Gas, Including Acetylene.

NO MERCURY OR GLYCERINE USED.

It is the most simple, inexpensive and effective governor on the market.
Made in three sizes only.
Should be attached by the gas company to insure correct work and best results.

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FOR SHUTTING OFF GAS IN MAINS TEMPORARILY DURING ALTERATIONS AND REPAIRS

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LINK-BELT ELEVATING & CONVEYING MACHINERY for HANDLING COAL, COKE, OXIDE, ETC.

Tilting Coal and Coke Cars,
Breaker Rolls, Shaking Screens,
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Machinery designed and erected to suit existing conditions and available space.

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Owners of the "SUTHERLAND" Patents for Water Gas Apparatus.

Gas, Electric Light, Water Works, and Electric Street Railways Built, Remodeled, Operated, Bought and Sold.

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Mendota, Ill.
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Joplin, Mo.
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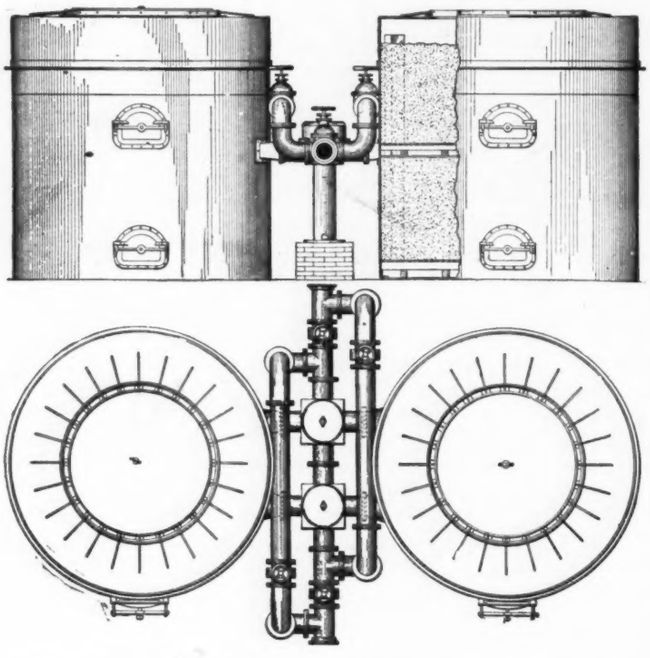
Youngstown, O.
Kingston & Rondout, N.Y.

CORRESPONDENCE SOLICITED.



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Covered by Five U.S. Patents.

In operation, revivification of the oxide is effected by repeated reversals of the direction of the flow of the gas through the beds (in the two boxes used under this system there are eight different routes for the gas to take) whereby the purified gas is made to revive the oxide in parts of the apparatus while the foul gas is fouling it in others.

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There are no Hydraulic Cups or heavy covers.

Either end of the apparatus is inlet or outlet at pleasure.

The capacity is increased five-fold or more over ordinary methods without addition to building.

The apparatus costs less than for any other system.

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For the Year 1898.

An Analysis of the Principal Gas Undertakings in England, Scotland and Ireland. Being the Thirtieth Year of Publication.
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Secretary and General Manager of The Gas Light and Coke Co., London.

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Exhausters, Governors, etc.

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Gas Enriching Plants to Enrich Coal Gas up to 24 Candle Power, and Making a White, Bright, Non-smoking Gas.

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LATEST IMPROVED GAS EXHAUSTER

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NEW GAS GOVERNOR AND STEAM VALVE.

GUARANTEED TO REGULATE WITHIN ONE-TENTH OF AN INCH, WATER PRESSURE.

The Most Perfect Gas Governor on the Market.

MORE DIRECT IN ACTION. FEWER PARTS.
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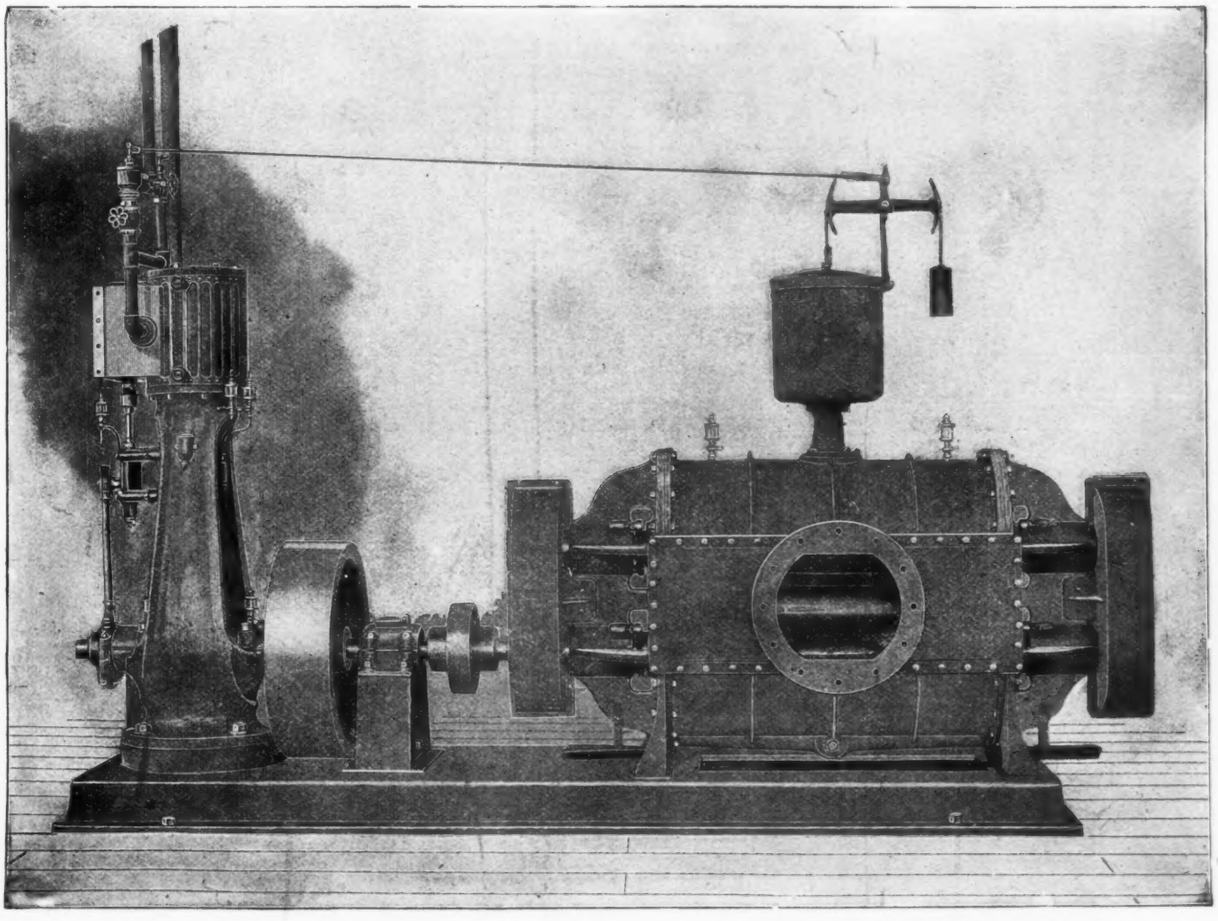

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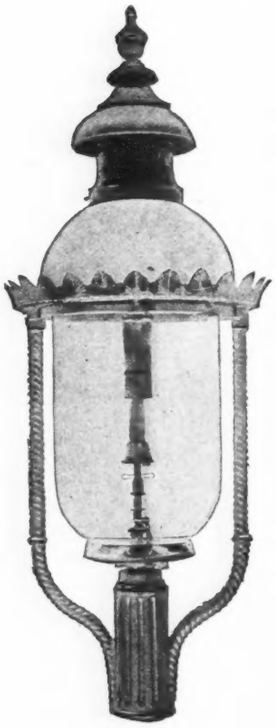
NEW YORK, 33 Nassau St. PHILADELPHIA, Broad and Arch Sts. CHICAGO, 54 Lake St.

Welsbach Street Lighting Company

.... OF AMERICA ....



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Welsbach System of Street Lighting,

Which includes its specially DESIGNED AND PATENTED BURNER for STREET and PARK LIGHTING exclusively.

Uniformly SUCCESSFUL in seventy-five Cities and Towns.

By means of the Welsbach System of street lighting the superiority of GAS over electricity for street lighting has been fully demonstrated.

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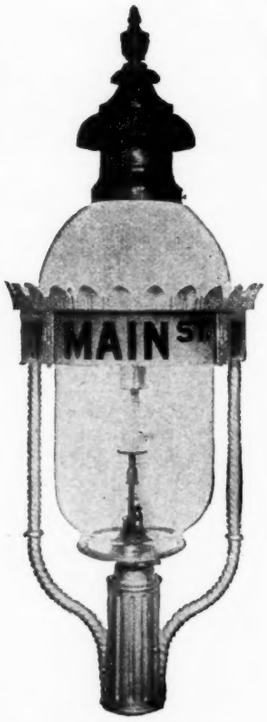
It is { Economical, Attractive, Successful, Up-to-date.

IT LIGHTS THE STREET.

Where there are no gas mains we can furnish an equally good light by our SELF-GENERATING NAPHTHA WELSBACH BURNER, and thereby supply a uniform light in all localities.



No. 38.

Correspondence solicited from Gas Companies and others interested in Municipal and outside lighting.

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— OF THE —

Handbook for Gas Engineers and Managers.

By THOMAS NEWBIGGING, M. Inst. C.E.

This Edition of the "Handbook for Gas Engineers and Managers" is a great improvement on all previous editions. Much of the text has been re-written, in order to keep the work abreast of the constant advances that are being made in the Gas Industry.

PRICE, - - $6.00.

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GAS ENGINES

With Instructions for Care and Working of the Same.

By G. LIECKFELD, C.E.

Translated with Permission of the author by GEO. M. RICHMOND, M.E.

Price, $1.00.

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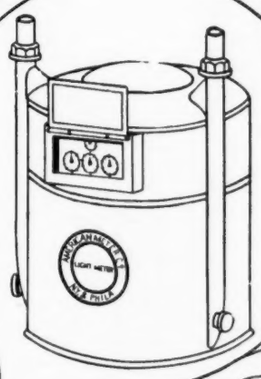
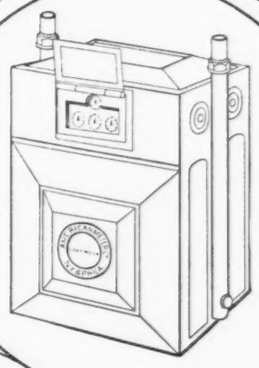
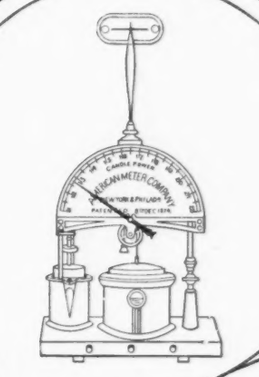


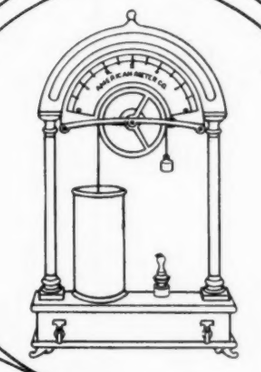


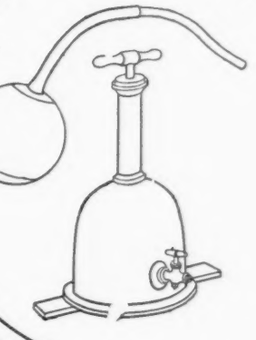
PUBLIC LIGHTING TABLE.

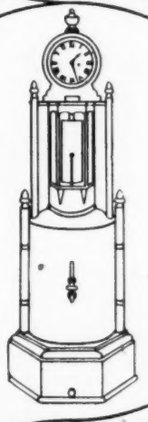
JUNE, 1900.

Day of Week.	Date.	Table No. 1. Following the Moon. Light.	Table No. 1. Following the Moon. Extinguish.	Table No. 2. New York City. All Night Lighting. Light.	Table No. 2. New York City. All Night Lighting. Extinguish.
				P.M.	A.M.
Fri.	1	7.50 PM	3.30 AM	7.15	3.15
Sat.	2	10.10	3.30	7.15	3.15
Sun.	3	10.40	3.30	7.15	3.15
Mon.	4	11.00 FQ	3.30	7.25	3.15
Tue.	5	11.30	3.30	7.25	3.15
Wed.	6	11.50	3.30	7.25	3.15
Thu.	7	12.20 AM	3.30	7.25	3.15
Fri.	8	12.50	3.30	7.25	3.15
Sat.	9	1.30	3.30	7.25	3.15
Sun.	10	2.10	3.30	7.25	3.15
Mon.	11	No L.	No L.	7.25	3.15
Tue.	12	No L. FX	No L.	7.25	3.15
Wed.	13	No L.	No L.	7.25	3.15
Thu.	14	8.00 PM	9.50 PM	7.25	3.15
Fri.	15	8.00	10.30	7.25	3.15
Sat.	16	8.00	11.10	7.25	3.15
Sun.	17	8.00	11.40	7.25	3.15
Mon.	18	8.00	12.10 AM	7.30	3.15
Tue.	19	8.00 LQ	12.50	7.30	3.15
Wed.	20	8.00	1.20	7.30	3.15
Thu.	21	8.00	1.50	7.30	3.15
Fri.	22	8.00	2.30	7.30	3.15
Sat.	23	8.00	3.30	7.30	3.15
Sun.	24	8.00	3.30	7.30	3.15
Mon.	25	8.00	3.30	7.30	3.15
Tue.	26	8.00 NM	3.30	7.30	3.15
Wed.	27	8.00	3.30	7.30	3.15
Thu.	28	8.00	3.30	7.30	3.15
Fri.	29	8.00	3.30	7.30	3.15
Sat.	30	8.00	3.30	7.30	3.15



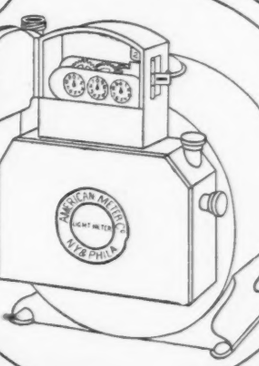


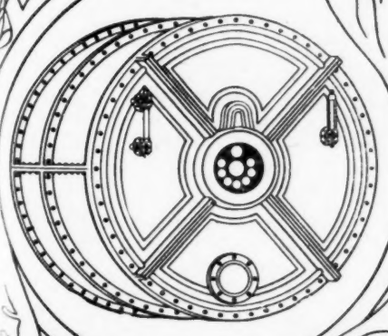




TOTAL HOURS LIGHTING DURING 1900.

By Table No. 1.	Hrs.Min.	By Table No. 2.	Hrs.Min.
January	230.50	January	423.20
February	175.40	February	355.25
March	189.00	March	355.35
April	160.30	April	298.50
May	150.40	May	264.50
June	137.00	June	234.25
July	152.00	July	243.45
August	171.50	August	280.25
September	187.20	September	321.15
October	213.10	October	374.30
November	221.50	November	401.40
December	231.50	December	433.45
Total, yr.	2221.40	Total, yr.	3987.45





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Total Daily Capacity - - - - - - - - - 207,425,000 Cu. Ft.

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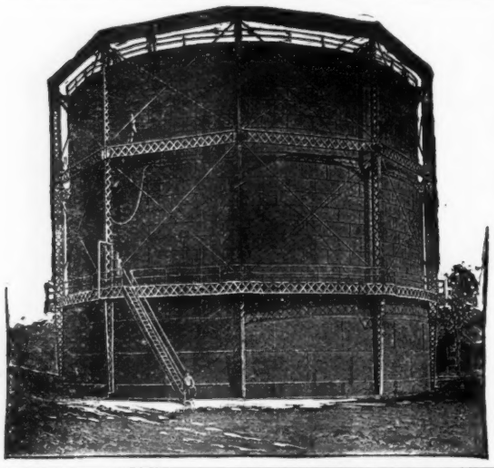

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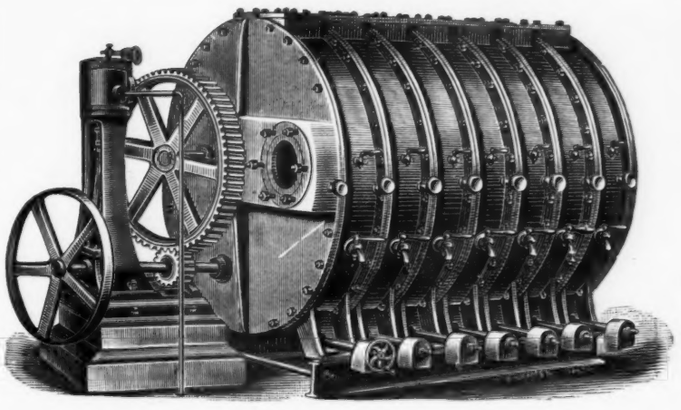

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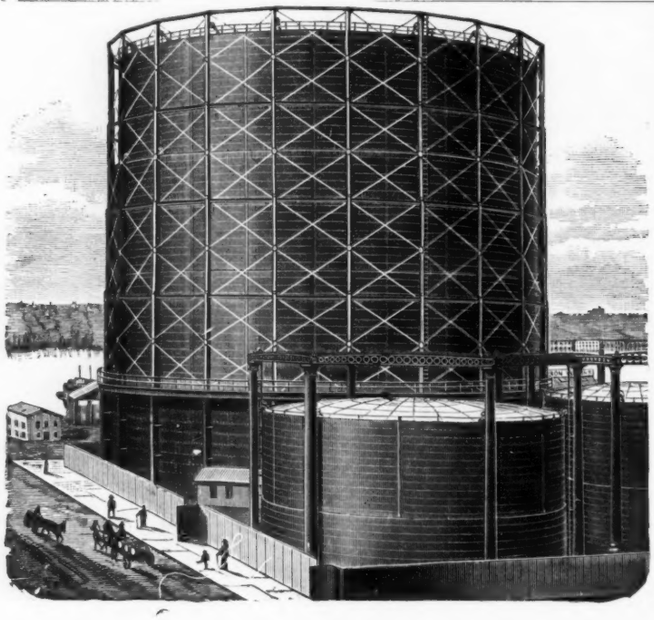

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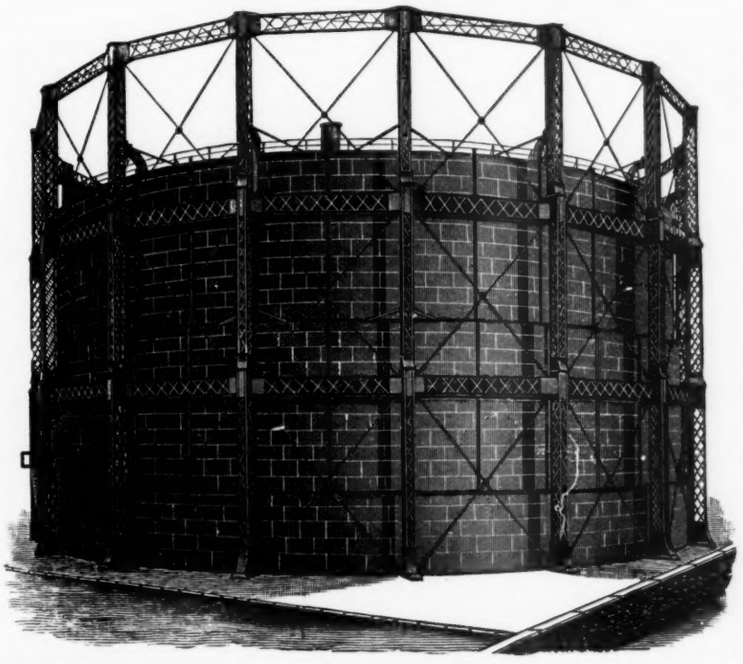

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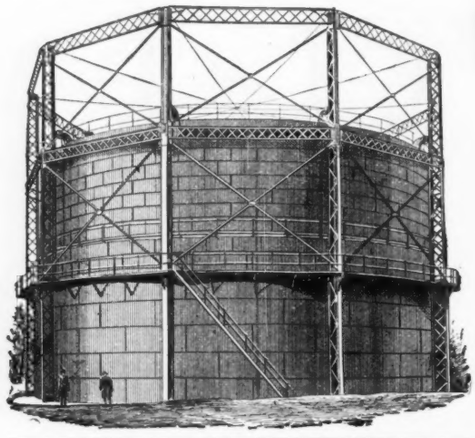

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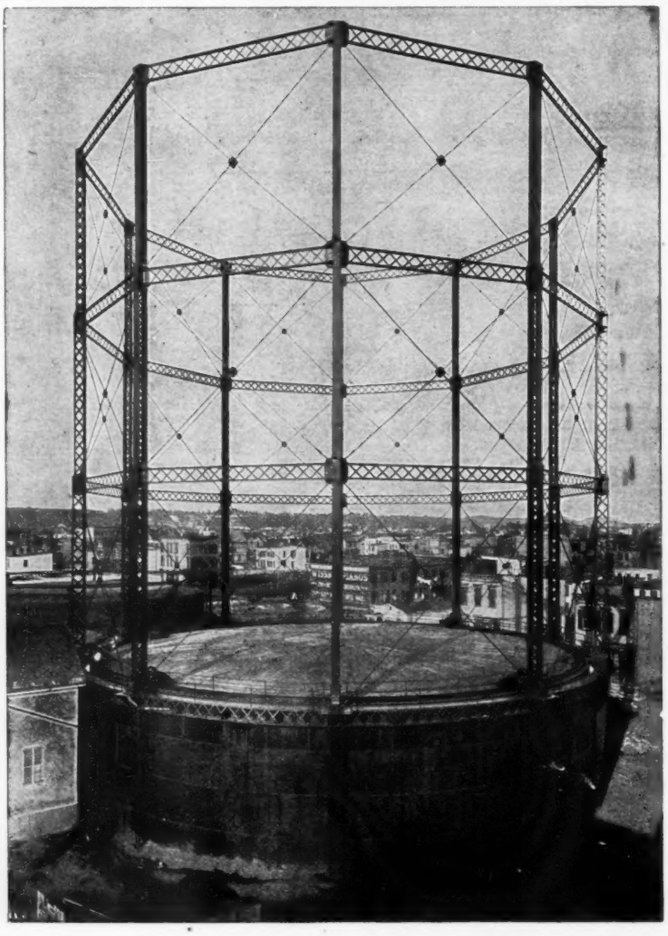

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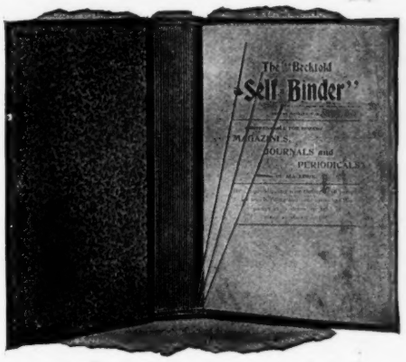

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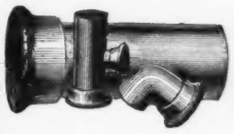

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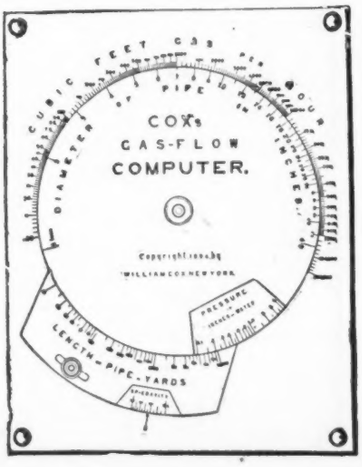

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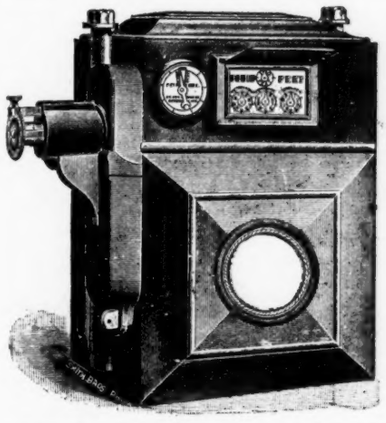

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